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IMPROVING THE VALUE ENGINEERING CHANGE PROPOSAL
PROCESS WITHIN THE U.S. ARMY
CORPS OF ENGINEERS

A Thesis

Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Civil Engineering

by

Gerald Wayne Mahaffee

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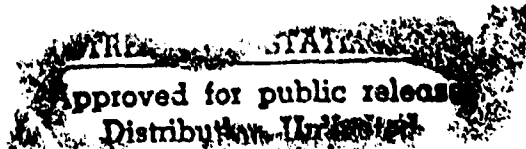
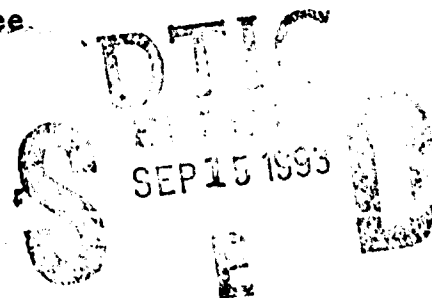
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ABSTRACT

Partnering has brought a new philosophy to the U.S. Army Corps of Engineers. Partnering has encouraged members of the Corps of Engineers and contractors to work together on project teams, opposed to developing adversarial relationships. Because of partnering, other improvements to processes within the Corps of Engineers can occur.

One area of possible improvement is in the Corps of Engineers Value Engineering Program. Presently, contractors may submit ideas to improve a project in the form of a Value Engineering Change Proposal (VECP). The VECP process is viewed by many contractors as slow and cumbersome. Even members of the Corps of Engineers feel improvements to the VECP process can be made.

In this research, a VE Mini-Study is introduced to align the present VECP process to the concepts of partnering (based on teamwork and common goals). The VE Mini-Study involves the development of VECPs on a team with members of the Corps of Engineers, the contractor, Architect/Engineer (A/E), and the customer/user after the construction contract is awarded.

Surveys conducted and analyzed with several contractors and experts from the Corps of Engineers show favorable results to the feasibility of conducting VE Mini-Studies for certain projects. Factors affecting the success of a VE Mini-Study and the project selection process are also presented.

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

	Page
TITLE PAGE	i
ABSTRACT	ii
ACKNOWLEDGEMENTS	iii
LIST OF TABLES	vi
LIST OF FIGURES	vii
 CHAPTER	
I. INTRODUCTION	1
Research Objective	3
Scope of the Research	3
Thesis Organization	4
II. VALUE ENGINEERING IN THE CORPS OF ENGINEERS	5
Defining Value Engineering in the Corps of Engineers	5
History of Value Engineering in the Corps of Engineers	6
The Value Engineering Study	7
The Value Engineering Job Plan	8
Function Analysis System Technique (FAST)	17
Teamwork and Team Dynamics	23
Value Engineering Change Proposals	25
III. PARTNERING IN THE CORPS OF ENGINEERS	29
What is Partnering?	29
Why Partnering?	31
The History of Partnering in the Corps of Engineers	33
Observed Problems of Partnering	34
Partnering Workshops	35
Partnering and the Contract for Projects Within the Corps of Engineers	37
Implementing Partnering	38
IV. ALIGNING VALUE ENGINEERING TO PARTNERING	40
The Need for Alignment	40
Recommendations for Change	41
The Value Engineering Mini-Study	43

Table of Contents (Continued)

	Page
V. VALIDATIONS	51
Methodology	51
Analysis of the Responses	53
Summary of the Surveys Conducted	64
VI. CONCLUSIONS AND RECOMMENDATIONS	66
Conclusions	66
Recommendations	68
APPENDICES	70
A. The Omaha District's VECPs Submitted In Fiscal Year 1992	71
B. Graphical Representations of the VECP Processing Times	73
C. A Generic Partnering Workshop Recommended By the Associated General Contractors Of America (AGC)	75
D. The Corps of Engineers' Policy Memorandum on Partnering	77
E. A Generic Value Engineering Mini-Study Agenda	79
F. The Initial Contractor's Survey	80
G. The Second Contractor's Survey	92
H. The Corps of Engineers' Survey	97
I. Respondents of the Surveys Conducted	108
BIBLIOGRAPHY	109

LIST OF TABLES

	Page
TABLE	
4-1. Sample Calculations for Determining the Actual Savings When the Savings Produced Exceeds the Developmental Costs	46
4-2. Sample Calculations When the Actual Savings are Less Than the Developmental Costs	46
4-3. Advantages and Disadvantages of a VE Mini-Study	48

LIST OF FIGURES

FIGURE	Page
2-1. Ability to Influence Cost	5
2-2. Function Analysis of a Pencil	13
2-3. Typical FAST Diagram	19
2-4. A Simple FAST Diagram of a Storm Sewer	22
2-5. Accumulated Goals and Savings from All VE Activity	26
2-6. Omaha District VECP Flow Chart	27
3-1. Common Goals	30
3-2. Conflicts While Obtaining Goals	31
5-1. Contractors' Rating of the Present VECP System	54
5-2. Contractors' Rating of the VE Mini-Study Compared with the Current VECP System	56
5-3. Size of Construction Companies Responding to the Surveys	59
5-4. Responses of the Importance of Criteria Affecting the Success of a VE Mini-Study	61
B-1. FY 1992 VECPs, Omaha District	73
B-2. Distribution of Processing Times of VECPs Submitted	74

CHAPTER I

INTRODUCTION

Many changes have occurred because of the implementation of partnering within the U.S. Army Corps of Engineers. The traditional adversarial relationships between the Corps of Engineers and their contractors are beginning to cease. Partnering has brought a new business philosophy to the Corps of Engineers based on mutual trust, teamwork, open communication, and goal alignment (8). This philosophy brings changes to the construction industry just as the fall of communism in the former Soviet Union has brought changes to international politics. One of the areas most affected by this new philosophy within the Corps of Engineers is Value Engineering (VE).

In the Corps of Engineers, VE is the method used to satisfy the user's needs at the lowest life cycle cost through applied creativity (17). A project can be made better if it fulfills the needs of the end user at a lower cost to the Government. The Corps of Engineers generates most of their savings by studying the project early in the design phase when they have more potential to influence the cost of the project (12).

After the construction contract is awarded, the Corps of Engineers will also accept suggestions from the contractor for improving the project. These suggestions are normally submitted in the form of a Value Engineering Change Proposal (VECP) (17). If the VECP is accepted by the Corps of Engineers, any cost savings generated by the VECP are shared with the contractor.

Although the VECF may seem like an excellent method for a contractor to earn extra money, VECFs generate only a very small portion of the total savings within the Corps of Engineers (6). One possible explanation for this may be that VECFs are submitted after the design is complete when the ability to influence the costs is less (12). Other explanations may be that the VECF system is not viewed by the contractor as cost effective or user friendly.

Initial research interviews indicate that personnel from the Corps of Engineers and contractors are dissatisfied with the current VECF system (10). Processing times for VECFs may take as long as 45 days just to get an approval or disapproval from the Corps of Engineers (11). A Project Manager for G.E. Johnson Construction Company, stated that the value engineering (VECF) concept discourages contractor participation since the Corps is locked into too many procedures and regulations which often makes submitting VECFs cumbersome and not cost effective (10). When asked about improving the contractor's participation in the Corps' Value Engineering Program, several key individuals in the Omaha District Office stated that the VECF process must "be simple and quick" (Appendix H).

In fiscal year 1992, the Omaha District received only 56 VECFs on \$144 million of construction (11). According to Steve Moore, Value Engineering Officer for the Omaha District, FY 1992 was one of their better years for receiving VECFs (11). Of the 56 VECFs, only 34 (61%) were approved or partially approved. The average total savings (before splitting between the Government and the contractor) was \$19,405 (Appendix A). The contractor receives no compensation for fully developing a VECF which is eventually disapproved. The processing times, approval rates,

and bureaucracy (paperwork) involved discourage the contractor from submitting a VECP.

Research Objective

The primary objective of this research is to present a study on how to enhance the Value Engineering Program in the Corps of Engineers by increasing the contractor's participation within the program. Partnering is the key to providing the avenue for increasing the contractor's participation. Because of partnering, the contractor can work with the Corps of Engineers to achieve the common goal of increasing the value of a project. Some supporting objectives of this thesis include:

1. Improve the VECP system under the current federal law and regulations (Federal Acquisition Regulation).
2. Minimize any cost or risk to all parties involved with the VECP process.
3. Streamline existing VECP procedures to reduce processing times and to stimulate more creative ideas.

These supporting objectives will ensure the primary research objective is met, while considering all parties involved with the VE process.

Scope of the Research

The scope of the research generally is limited to the Value Engineering Program of the Omaha District of the U.S. Army Corps of Engineers. Most of the data provided came from historical records of the Omaha District Value Engineering Office. Furthermore, the names of the contractors surveyed were provided by the Omaha District. Since there are a limited number of VE experts within the Corps of Engineers, other Value Engineering Officers (VEOs) within the Corps had input into this research. While other districts within the Corps of Engineers are very similar in their organization and functions, the daily operations of one district

will differ from another depending on its mission, location, and size (10). All districts in the Corps of Engineers are required to follow the same federal laws, regulations, and policies established by Headquarters, U.S. Army Corps of Engineers (HQUSACE). Since all districts function under similar policies and regulations, the recommendations presented in this thesis could apply to all districts.

Thesis Organization

Chapters II and III are the literature review chapters. Chapter II focuses on Value Engineering (VE) in the Corps of Engineers while Chapter III discusses partnering in the Corps. Both chapters are provided to give the necessary background and understanding required to comprehend the need for and the purpose of the research.

Chapter IV addresses the need for the Corps of Engineers to align their Value Engineering Program to the partnering concept. Additionally, the recommendation for the Corps of Engineers to conduct a VE Mini-Study with a construction contractor is introduced. The VE Mini-Study is proposed to meet the research objectives.

In Chapter V, the possibilities of conducting a VE Mini-Study are explored and validated by several experts of the Corps of Engineers and construction contractors. Criteria required for conducting a VE Mini-Study are also established.

Conclusions of this research and recommendations for further enhancements of the Corps of Engineers' Value Engineering Program are presented in Chapter VI.

CHAPTER II

VALUE ENGINEERING IN THE CORPS OF ENGINEERS

Defining Value Engineering in the Corps of Engineers

Value engineering is defined as a creative, organized approach whose objective is to optimize cost and/or performance of a facility or system (4). In construction, the greatest ability to influence the cost of the project is in the early stages of the project's duration (12). As time progresses, it becomes more difficult to influence the cost of the project. Likewise, the cost to make a change in the project will increase as time passes (4). These facts are critical to the concept of value engineering. Figure 2-1 (12) gives a graphical representation of the cost influence potential.

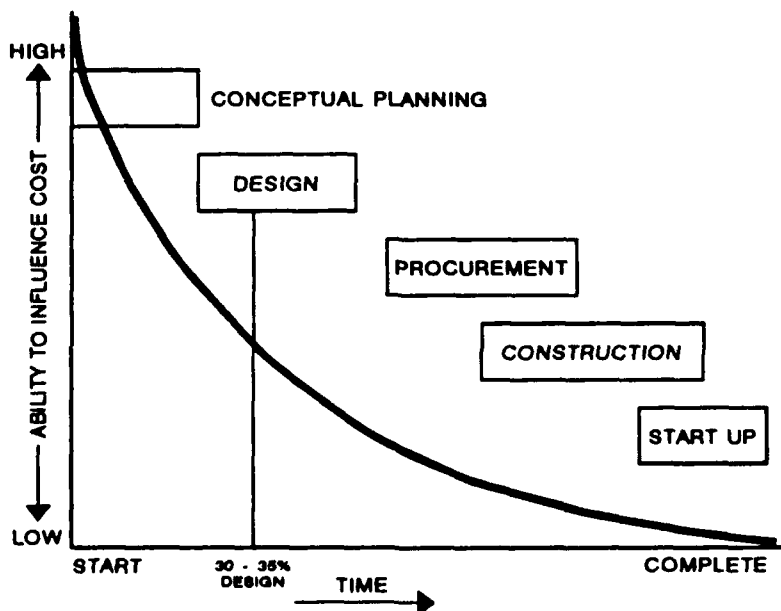


Figure 2-1. Ability to Influence Cost

Since the definition of value engineering differs from one organization to the next, it is critical to understand the Corps of Engineers' definition:

Value engineering is an organized study of functions to satisfy the user's needs at the lowest life cycle cost through applied creativity (16).

An important point to note in this definition is the focus on the user's needs. Developing an understanding of the user's needs is critical to the success of value engineering. When conducting an organized study of the functions of a project, the user must be well integrated into the process.

History of Value Engineering in the Corps of Engineers

Value engineering in the Corps of Engineers is a relatively new concept. In World War II, some products were very hard to procure. This caused many people to seek out adequate substitutes for the items they could not obtain. General Electric (GE) recognized that although some substitute products were inferior to the original product, other substitute products were superior and less expensive than the original (18).

In 1947, Harry Erlicher, Vice President of Purchasing, wanted to improve product efficiency by intentionally substituting materials to take over the function of more costly materials (18). Erlicher appointed one of his staff engineers, Lawrence Miles, to investigate the feasibility of substituting one product for another in order to increase efficiency. Miles developed a system of techniques called "value analysis" to make improvements systematically rather than by accident (4). Today, the two terms "Value Analysis" and "Value Engineering" are used synonymously (4).

Value engineering was first introduced to the construction industry in 1963 by Alphonse Del'Isola. Del'Isola introduced the value engineering incentive provisions in Department of Defense (DOD) construction contracts to the Navy Facilities Engineering Command (4). In 1964, the U.S. Army Corps of Engineers began implementing a Value Engineering Program (6). By the end of 1991, the U.S. Army Corps of Engineers estimated that it has saved a total of 2.29 billion dollars in both military and civil construction projects due to value engineering (6).

The Value Engineering Study

The Value Engineering (VE) Study is the organized method the Corps of Engineers uses to bring a team together to analyze a project. The VE Study may focus on the entire project or specific areas. In a VE Study, representatives from the Corps of Engineers, the Architect/Engineer (A/E), and the customer/user get together to analyze how they can meet the needs of the user at the lowest life cycle cost (11). These representatives normally have the authority from their respective organizations to develop and authorize the recommended changes. On the average, a typical VE Study will take approximately 40 hours (one week) to complete (11). In the Omaha District, a VE Study will normally occur when 30% - 35% of the design is complete (See Figure 2-1) (11). The cost of conducting a full 40 hour VE Study is approximately \$50,000 to \$60,000 (11).

Both size and type of project will affect the decision to conduct a VE Study. Many times, small projects do not warrant the expense of conducting a VE Study, while very large projects may warrant several studies during the project life. If similar projects have been constructed in the past, the opportunities of achieving substantial savings may be diminished. An example of this may be a troop barracks

facility previously constructed on several military installations. Although there may be some slight differences between the facilities, the basic structure is still the same. VE Studies conducted on the previous facility may give a good indication whether or not another VE Study is warranted on the new facility.

The Value Engineering Job Plan

In the Corps of Engineers, the Value Engineering (VE) Job Plan is a systematic procedure and framework for accomplishing all the necessary tasks associated with a Value Engineering Study (17). The VE Job Plan uses function analysis and creativity to develop multiple alternatives while maintaining the needs of the user. Function analysis (which is addressed later) is the process of analyzing a project by its functions rather than its components.

In 1982, Alphonse Del'Isola published a book, Value Engineering in the Construction Industry, that outlined a four phase VE Job Plan (2):

1. Information: Get Facts
2. Speculative: Brainstorm
3. Analytical: Investigate, evaluate
4. Proposal: Sell

The Corps of Engineers uses a five phase VE Job Plan which is similar to Del'Isola's. However, they take his Proposal Phase and split it into two distinct phases. The five phases of the Corps of Engineers' VE Job Plan are (2):

1. Information (for information gathering)
2. Speculation (for the generation of alternates)
3. Analysis (for evaluation of alternatives)
4. Development (for development of firm proposals)

5. Presentation (for presentation and implementation of recommendations)

Each one of the above phases contains a series of guidelines and questions that must be answered to ensure thoroughness of each phase.

The Information Phase

The primary purpose of the information phase is to develop a thorough understanding of the item under study and to clarify it through the description of its function(s). In the Corps of Engineers, four basic questions must be answered (17):

1. What is it?
2. What does it do?
3. What must it do?
4. What does it cost?

The focus of the information phase is to gather the facts about the portion of the project being studied. To do this, the facilitator of the study (normally a VE Officer from the Corps) must encourage open participation while insuring that only factual information is presented. These facts must be investigated thoroughly. Some examples of the investigated facts include performance information, present cost, construction techniques, and quality requirements (17).

Identifying the Item Under Study. Correctly identifying the item under study (What is it?) is the first step of the information phase. Portions of a project may be identified if their associated costs are higher than previous projects. Another method for identifying an area of a project is by its cost/worth ratio (cost/worth ratios are discussed later). In any method used, careful attention must be given to identifying all components of the item under study.

The Function Approach. To answer the second and third basic questions, the team must understand the functions of the item being studied. The function approach will determine the areas in need of improvement and isolate needless or low value items (17).

The Corps of Engineers defines function as "the specific purpose or intended use of an item. It is the characteristic which makes the customer or user buy a product" (17). Defining the function or functions of an item may take several sentences. Although using full sentences will give an adequate definition of the item's function, it is normally not workable or concise enough for value engineering purposes. Therefore the VE function approach uses two words, an active verb and a measurable noun, to describe a particular function of an item. The active verb must be carefully selected because it answers the question, "What does it do?" For instance, the basic function of a power line to a house may be "transports electricity." The measurable noun must accurately describe the object that receives the action from the verb. The function of the same power line could be given as "provides service." However, "service" is vague and does not adequately describe the function of the power line.

The system for defining a function by a single verb and noun is often referred to as the two-word definition (17). Although defining a function by using only two words may seem awkward, using the two-word definition has three distinct advantages:

1. It requires the definition to be concise and avoids wordy definitions.
2. It prevents combining functions and describing more than one simple function.
3. It describes the specific function.

To prevent confusion, a single word modifier may be used to describe a function (4). Some examples of this are "generate power (electrical)" and "provide security (physical)."

Functions are categorized into three types - higher order, basic, and secondary. Higher order functions are those functions that describe the ultimate purpose for a higher level, as in the entire project's function. Basic functions are the required reason for the existence of an item or product and will answer the third question "What must it do?". Since basic functions are always determined by the user or customer, an item may have several basic functions depending on the user's needs. For example, if a person reads a book, then the basic function of the book may be "displays information." However, if the person uses the book to hold a door open, then the basic function of the book is "retains door." Secondary functions are those functions that are not essential to the user or do not contribute directly to the basic function. Secondary functions often answers the question of "What else can it do?" Secondary functions may give added convenience or may improve the appearance (aesthetics) of the item (4).

Value. There are several different definitions for value. Generally, all definitions fall into one of four categories - economic, esteem, use, and exchange values (4). Economic value is the sum of the costs of materials, labor, equipment and other monetary costs associated with producing the item and answers the fourth question "What does it cost?" Esteem value refers to the aesthetics and appearance of a particular item. Use values are those that satisfy a particular need for an individual. Exchange values are those features an item has which may

be used in an exchange or trade. Value engineering is normally concerned with only the economic and use values of an item.

In value engineering, the value of an item is normally represented by the cost/worth ratio (4). The cost in this ratio refers to the economic value of the item whereas the worth refers to the use value of the item. The lower cost/worth ratio produces the greater value. "Cost" may be obtained by simply summing the costs associated with producing the item. "Worth" is normally represented by the cost associated with achieving the basic function(s) of the item and any required secondary functions. Since worth is determined by the functions of the item, is it critical to understand the requirements of the user. As a general rule, Del'Isola suggests that items with cost/worth ratios greater than 2.00 may have the potential for savings (4).

A Simplified Example (4). To illustrate the previous concepts, Del'Isola gives a simplified example using a wooden pencil. Figure 2-2 shows an example of the functional analysis of a wooden pencil (4). In this case, the basic function of a wooden pencil is to "make marks." All other functions of the wooden pencil are secondary functions. The pencil is then broken down into its components with each having its own function(s). Note that the function of the graphite (make marks) is the same as the entire system. If there are no requirements of the user other than to make marks, then the total worth of the pencil is \$0.04. This gives a cost/worth ratio of 3.5 ($14/4 = 3.5$). However, by placing additional requirements on the same pencil, the worth of the pencil increases. For example, the user could state that he wants a pencil that also erases and advertises his company. In this example, the worth of the pencil increases by three cents (due to the eraser and the markings on the

pencil) giving the cost/worth ratio of 2.0 ($14/7 = 2.0$). Note that in this example the markings printed on the pencil changes from "identify product" to "advertise company." This is an example of how the worth of a system can increase by knowing and meeting the requirements of the user.

Component	Function		Kind	Cost	Worth
	Verb	Noun			
Pencil	Make	Marks	B	\$0.14	
Eraser	Remove	Marks	S	\$0.02	
Ferrule	Hold	Eraser	S	\$0.01	
Wood	Hold	Lead	S	\$0.05	
Paint	Protect	Wood	S	\$0.01	
	Provide	Beauty	S		
Markings	Identify	Product	S	\$0.01	
Graphite	Make	Marks	B	\$0.04	\$0.04
		Cost/Worth Ratio =		$14/4 = 3.5$	

Figure 2-2. Function Analysis of a Pencil

If the only requirement is to make marks, it is simple to delete the eraser, ferrule and markings. By doing this, the total cost of the pencil drops to ten cents which gives a cost/worth ratio of 2.5 ($10/4 = 2.5$). Since the pencil still has a cost/worth ratio of 2.5, the value engineer may ask if there are any deletions that could be made. Moreover, the value engineer may ask if there are any other alternatives that could perform the same functions at a lower cost.

Life Cycle Cost Analysis. The value, or worth, of any item cannot be determined without considering its economic life. The Corps of Engineers defines Life Cycle Cost Analysis (LCCA) as "the systematic evaluation of alternative designs and the comparison of their projected total owning, operating, maintenance, and disposal costs or retention value over the specified time" (17). Under LCCA, the total cost of the item must be considered over the duration of its anticipated life.

Life cycle cost may be computed in several different ways. Often, the life cycle cost of an item or alternative is computed by obtaining its present worth. This computation is done by summing the present values of all associated costs over an assumed life expectancy and interest rates. Another method compares the annual costs of the alternative. This may be easier for someone to calculate, especially when the life spans of the alternatives being analyzed differ.

The Speculation Phase

The purpose of the speculation phase is to generate creative and alternate means for accomplishing the same function(s) as those identified in the information phase (17). Once all the information for an item under study has been gathered and analyzed, common sense questions are also asked about the area being studied. Some of these questions may include the elimination, simplification, and combination of functions. Additionally, the requirements of the user may be questioned. Many times, the user will request a particular specification without knowing the cost. Furthermore, the requirements of the user may change as the project progresses. In public construction, a project may be fully designed and shelved for several years while awaiting construction fund authorization (11).

In the speculation phase, creativity is critical. Ideas must be generated freely and individuals should attempt to depart from conventional methods and typical solutions. In the Corps of Engineers, brainstorming is used to generate the creative ideas. To stimulate creativity, members of the VE study team must initially accept all proposed solutions. Members of the team should feel encouraged to make a suggestion without fear of immediate rejection or ridicule. Analysis of any ideas should be tabled for discussion until the team has presented all possible solutions.

The Analysis Phase

During the analysis phase, the team will carefully review the ideas and alternatives that were generated in the previous phase. The ultimate objective of the analysis phase is to determine which alternative(s) will offer the greatest savings while providing the lowest risk to the decision maker or approving authority (17).

The first step in the analysis phase is to do a preliminary screening of all the alternatives. Preliminary screening eliminates those alternatives that are not determined to be feasible. In the preliminary screening, past experience of the team members and common sense will play an important role. The team must keep in mind that the original design, or status quo, is an alternative that should be evaluated along with the ideas generated in the speculation phase. No alternative should ever be discarded without at least going through a preliminary screening.

The preliminary screening will produce a shorter list of alternatives that can be further refined. Detailed cost estimates may be prepared and dollar amounts assigned for the surviving alternatives to determine the most economical alternative. Many times, the VE study team

may require assistance of others in preparing the estimate or getting an answer to a question that requires expertise in a particular area.

The team will then decide on the criteria that will be used in evaluating the alternatives. Since the criteria used will have a major impact on the final alternative selected, careful consideration must be given to the criteria selection. The criteria will vary when evaluating each set of alternatives. The team may assign weights to the different criteria depending on their relative importance. The team would place the criteria into an alternative matrix, sometimes referred to as a decision matrix, which will aid in the selection of the best alternative(s) (17).

The Development Phase

The purpose of the development phase is to fully develop the alternative(s) selected in the analysis phase. Careful attention must be given to ensure that the needs of the user are continually met when developing a proposed alternative. Furthermore, the technical adequacy of the alternative must be met along with accurate cost estimates and effects on the project schedule.

During this phase, the team may need to interact with several agencies. Managers, designers, estimators, schedulers, and material vendors may be consulted to fully develop an alternative. Failing to fully develop an alternative may have a large negative impact on the project.

The end result of the development phase is a written report that summarizes the results of the investigation, recommends specific action, and requests approval from the approving authority. The report should be clear and concise. At a minimum, the report should describe the problem or scope of the study, list the possible alternatives, give the pertinent

cost and scheduling impacts, and summarize the savings of time and money. The report should "sell" the recommendations of the team to the approving authority if a formal presentation is not given.

The Presentation Phase

Even the best value engineering proposals may be rejected by management. The presentation phase is used to present and "sell" management on the value engineering proposal(s). Changes, whether good or bad, are often met with resistance. The presentation may be in an oral or written form, or both.

In the Corps of Engineers, the written presentation method is more commonly used. If the value engineering study team consists of individuals who have the authority to accept or reject ideas for their respective organizations, the actual presentation and approval process may be only a formality. The approval from the contracting officer is usually a formality if the rest of the staff (engineers and managers), along with the designer and user, have already concurred with the recommendations. The presentation phase also may be used to convey the changes to the various personnel (other engineers and managers) not directly involved in the study.

Function Analysis System Technique (FAST)

One of the most useful tools when working through a VE Job Plan is the Function Analysis System Technique (FAST). Analyzing the components and functions of a wooden pencil is a relatively simple process. In construction projects, correctly identifying the components and their functions is not as simple. To aid in this procedure, many companies (including the Corps of Engineers) use the Function Analysis System

Technique (FAST) (17). FAST was developed and presented in 1965 by Charles Bytheway of Sperry-Rand's Univac division (4). Since its origin, FAST has evolved with a number of improvements in techniques and applications.

FAST is a technique which uses a function block diagram which answers the questions of What?, Why?, and How? The function block diagram is commonly referred to as a FAST Diagram. Figure 2-3 shows the typical components of a FAST Diagram (4). Although it may appear that the FAST Diagram is very similar to a flow chart or CPM (Critical Path Method), it is not. The overall difference between FAST Diagrams and other diagrams is that FAST Diagrams are function dependent whereas other diagrams are dependent on time.

Applications

Since a FAST Diagram is a graphical representation of functions and their relationships, it can be used to communicate a wealth of information in a relatively small space. Depending on the complexity of the area being studied and the proficiency of the person(s) developing the diagram, it may take a few minutes or several hours to develop.

The primary purpose of the FAST Diagram is problem solving. A FAST Diagram answers three common sense questions - What is the problem?, Why is a solution necessary?, and How can the solution be accomplished? (4) It is important to note that the FAST Diagram is a tool and its significant impact is the thought process that goes into its development. Therefore, FAST does the following (4):

1. Determines and defines the main problems and their components within a particular area.
2. Avoids the common practice of finding the right solution to the wrong problem.

3. Breaks a complex problem into smaller manageable problems allowing the person(s) involved to focus on a particular problem without being overcome by the project complexity.
4. Provides a good balance between the high level aspects of a problem and the how-to-do-it actions required for the problem solution.

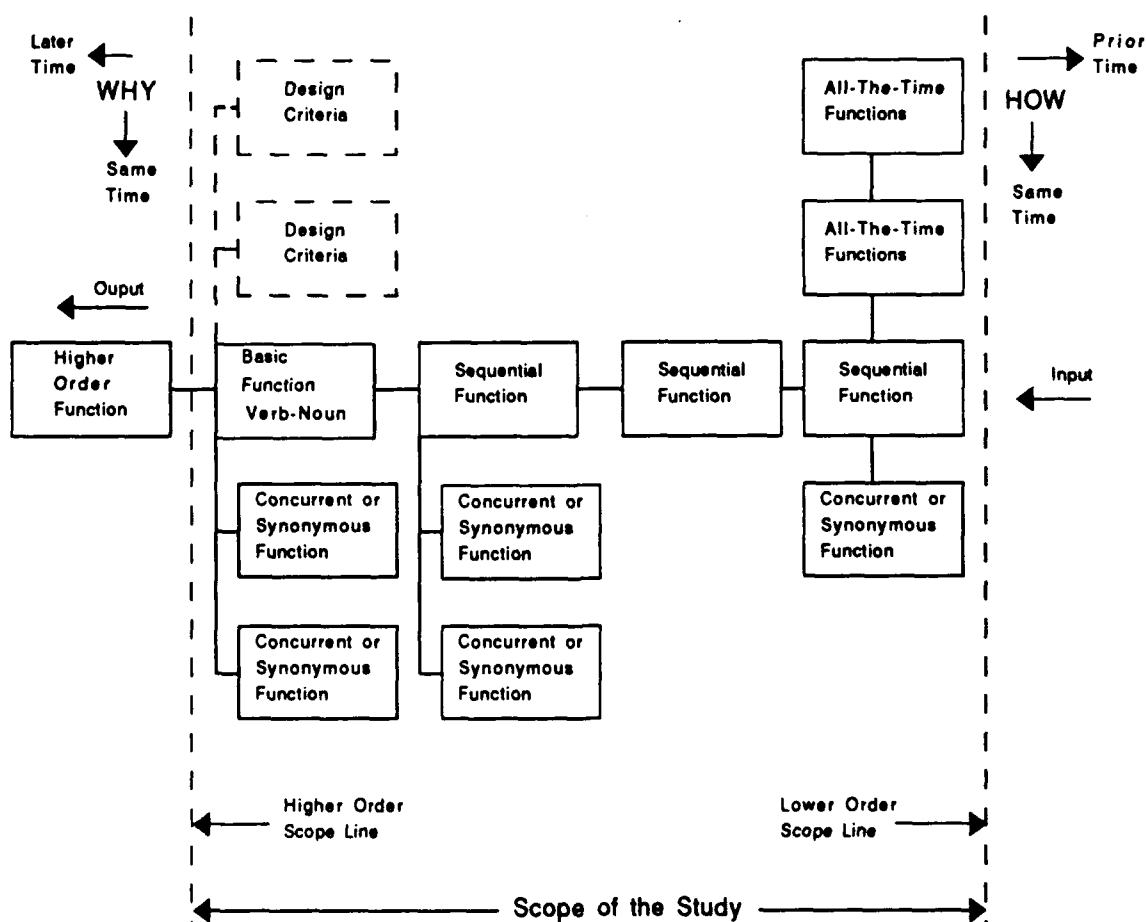


Figure 2-3. Typical FAST Diagram

Drawing the FAST Diagram

The first step in constructing a FAST Diagram is to determine the area that is to be studied. It usually is a portion of the entire project, although it is possible to diagram an entire project. Some areas of a project may warrant a study due to the high costs, size, or complexity of a particular area. Del'Isola refers to this as the scope of the problem (4).

The scope of the problem can be determined by a number of means. Normally, comparisons of other projects will provide a signal that a certain area may have to be studied. Some of the signals that a VE study is warranted are (17):

1. Item or components are expensive.
2. Item is complex.
3. Item has multiple uses.
4. Materials are critical.
5. Construction or fabrication is complex.
6. Maintenance and operation costs are high.
7. Item uses obsolete materials or methods.
8. Project design period was compressed.
9. Design is behind the "state of the art."
10. Design is a result of custom, tradition, or opinion.
11. Top management supports improvement of the item.
12. There are problems of implementation.
13. Design was not coordinated.
14. Project exceeds the budgeted amount estimated.

An example of this may be the office space within an Army headquarters building that may cost \$200 per square foot. Since other headquarters

office buildings in the past have cost considerably less, this cost would indicate that this building should be studied.

Once the scope of the problem is determined, the Corps of Engineers recommends the use of several small cards or pieces of paper on a large surface (17). By using the cards and two-word definition technique, the VE study team defines some of the functions of the area being studied on a separate piece of paper. By starting with any function, the team would ask the question:

"How do I (active verb) (descriptive noun)?"

The answer to this question will be placed directly to the right of the function that was in the question. Some questions may have multiple answers. These answers should be placed in a vertical orientation with each other. To check the diagram, the person(s) would then ask the question:

"Why do I (active verb) (descriptive noun)?"

The answer to this question should then be placed directly to the left of the function being examined. It may be necessary at any time during this process to rearrange the functions several times. The separate pieces of paper will facilitate the ease of rearranging the functions. When this process is complete, the pieces of paper will then begin to look like Figure 2-3. The "How?" and "Why?" precedence will be established in the horizontal direction while concurrent or synonymous functions will be in the vertical direction.

An example of this may be seen by analyzing the functions of a storm sewer. Figure 2-4 shows how these functions would be arrayed in a FAST Diagram. Here, the basic function may be defined as "controls runoff." The answer to the "How?" question may be to "transport water." The answer

to the "Why" question may be to "prevent floods." "Prevent floods" therefore becomes the higher order function while "transports water" becomes a sequential function. A manhole continuously "provides access" to the pipeline and is therefore considered a concurrent function to "transports water".

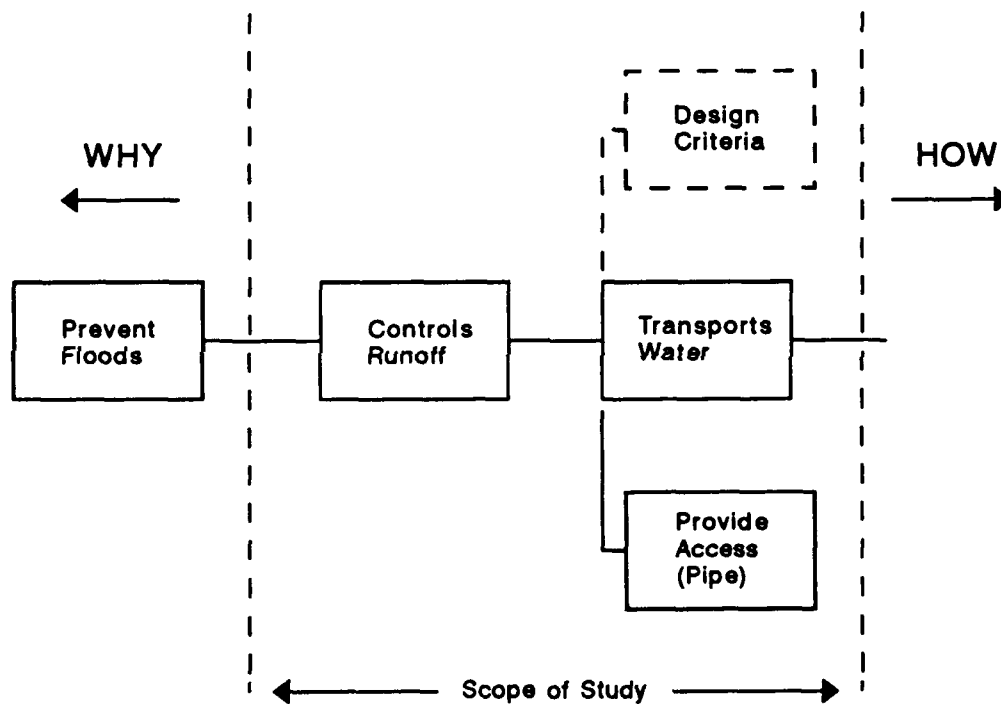


Figure 2-4. A Simple FAST Diagram of a Storm Sewer

The completed FAST Diagram enables people to see the breakdown of the project by its functions. Since the functions in the FAST Diagram use the two-word definition, the functions are easily divided into basic functions, required secondary functions, and other secondary functions.

Since the functions are also arrayed in a manner that shows their relationships with one another, the overall affect of one function can be seen within the scope of the problem.

Teamwork and Team Dynamics

The best way to conduct an organized study of a problem is by making effective use of teamwork and its creativity and synergy (17). Through teamwork, people can build on ideas and make them better. When an individual develops and presents a proposal, his ideas are open to criticism (approval/disapproval) from all individuals affected by the proposal. Teamwork allows for the integration of ideas of all individuals involved before they are developed into a proposal. Therefore, more time is spent on developing good ideas (those that are most likely to be approved) and less time is spent on developing bad ideas.

Team dynamics and human relations play an important role in the value engineering process (17). In construction, teamwork can improve coordination, schedule maintenance, productivity, work quality, individual satisfaction, and cost control (9). The value engineering team must be willing to succeed without individual team members being offended.

The Corps of Engineers recommends that a team utilize certain rules of conduct to avoid potential problems within the team (17). At the beginning of the team meeting, the facilitator could introduce certain rules of conduct. In addition, the team may want to add to these rules of conduct if they desire. The Corps of Engineers recommends the following rules of conduct (17):

1. Acquaint people with the nature and objectives of the work to be accomplished.

2. Promote VE as a team effort of the entire organization.
3. Respect the chain of command, customs of the organization, and personal characteristics of the people with whom you work.
4. Anticipate the likely adverse reactions to your work and think about how to deal with them.
5. Make suggestions, recommendations, and requests as clear as possible.
6. Make reports clear and accurate.
7. Never start a conversation with an individual by criticizing or belittling their work on an item under study.
8. Be careful in handling or making proposals which imply criticism, affect jobs or assignments, or reflect upon a particular individual.
9. Always have the facts to back up a proposal or report and be ready and able to present them clearly.
10. Consult with those who are affected by the proposed changes so that they don't feel you are operating behind their backs.
11. Avoid superior behavior.
12. Remember to listen carefully. Listen to what they say and respond to their thoughts and needs. The person who objects to a proposal may give a clue as to how it may be approved or modified so as to enable approval.
13. Show respect for the other person's opinions.

By following these rules of conduct, the team will ensure that all team members can actively participate without damaging the human relations between the team members.

Team members must also be aware of the several "roadblocks" that will prevent the effectiveness of the VE Study. These blocks generally fall into five different categories (17):

1. Habitual. This normally represents the "We have always done it this way" attitude.

2. Cultural. This is represented by the people who are afraid to present a new idea in fear that it may be perceived as being "radical."
3. Emotional. This occurs when a person is afraid of getting their feelings hurt. Team members should not take criticism personally.
4. Perceptual. This usually occurs when one team member fails to recognize the fact that another individual's perceptions are reality.
5. Negative Thinking. This is the common "It will never work!" syndrome.

The only way to overcome these roadblocks is to gain cooperation through sound human relations (17).

Value Engineering Change Proposals

After the award of the construction contract, the contractor may submit a Value Engineering Change Proposal (VECP). Currently, this is the only role the contractor plays in the entire value engineering process and it accounts for a very small percentage of the total VE savings. By the end of 1991, the VECP system accounted for only 4% of the total value engineering savings within the Corps of Engineers (6). Figure 2-5 shows the overall affect the VECs have had on the entire value engineering program within the Corps of Engineers (6).

These proposals are usually submitted by the contractor soon after the contract is awarded to allow ample time for the procurement of materials. The savings resulting from the VECP are split between the Government (45%) and the submitting contractor (55%). Currently, VECs are submitted on particular forms and follow a particular path until the submitting contractor receives his approval or disapproval notice. The path a VECP follows in the Omaha District is depicted in Figure 2-6 (11).

In fiscal year 1992, the Omaha District Value Engineering Office received only 56 VECs (see Appendix A for the VECs submitted in FY 92). Of those proposals, 34 VECs (or 61%) were approved or partially approved, which produced an average actual cost savings of \$19,406. The total actual savings (\$659,794) accounted for 0.46 percent of the total construction costs (\$144 million) for the Omaha District in that year.

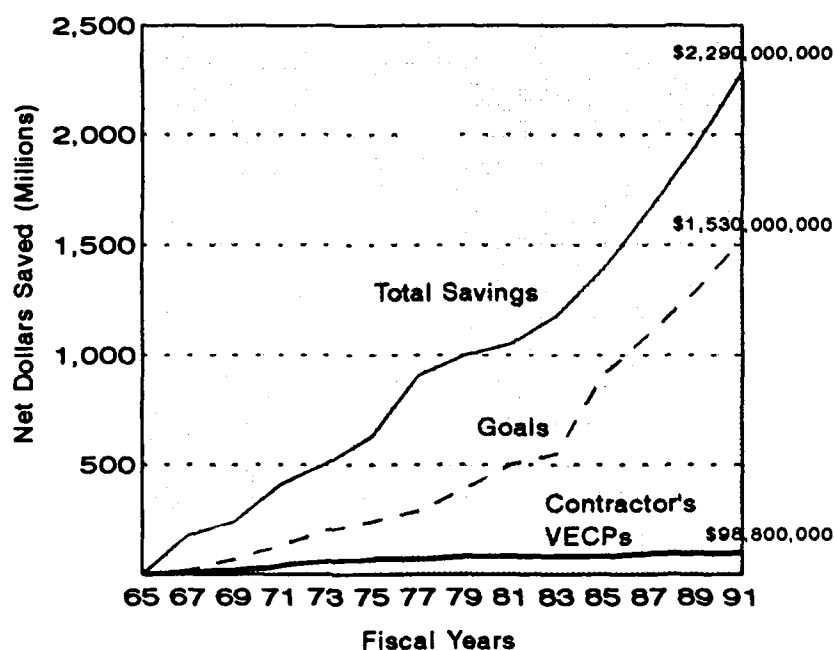


Figure 2-5. Accumulated Goals and Savings from All VE Activity

The VE Office is required to process a VEC within 45 days upon receipt of the VEC (7). The average time it took to process a VEC in 1992 in the Omaha District Office was 13 calendar days (see Figure 2-6). This time does not account for processing the VEC at the regional Area Office or mailing/delivery time. An additional five days is a very

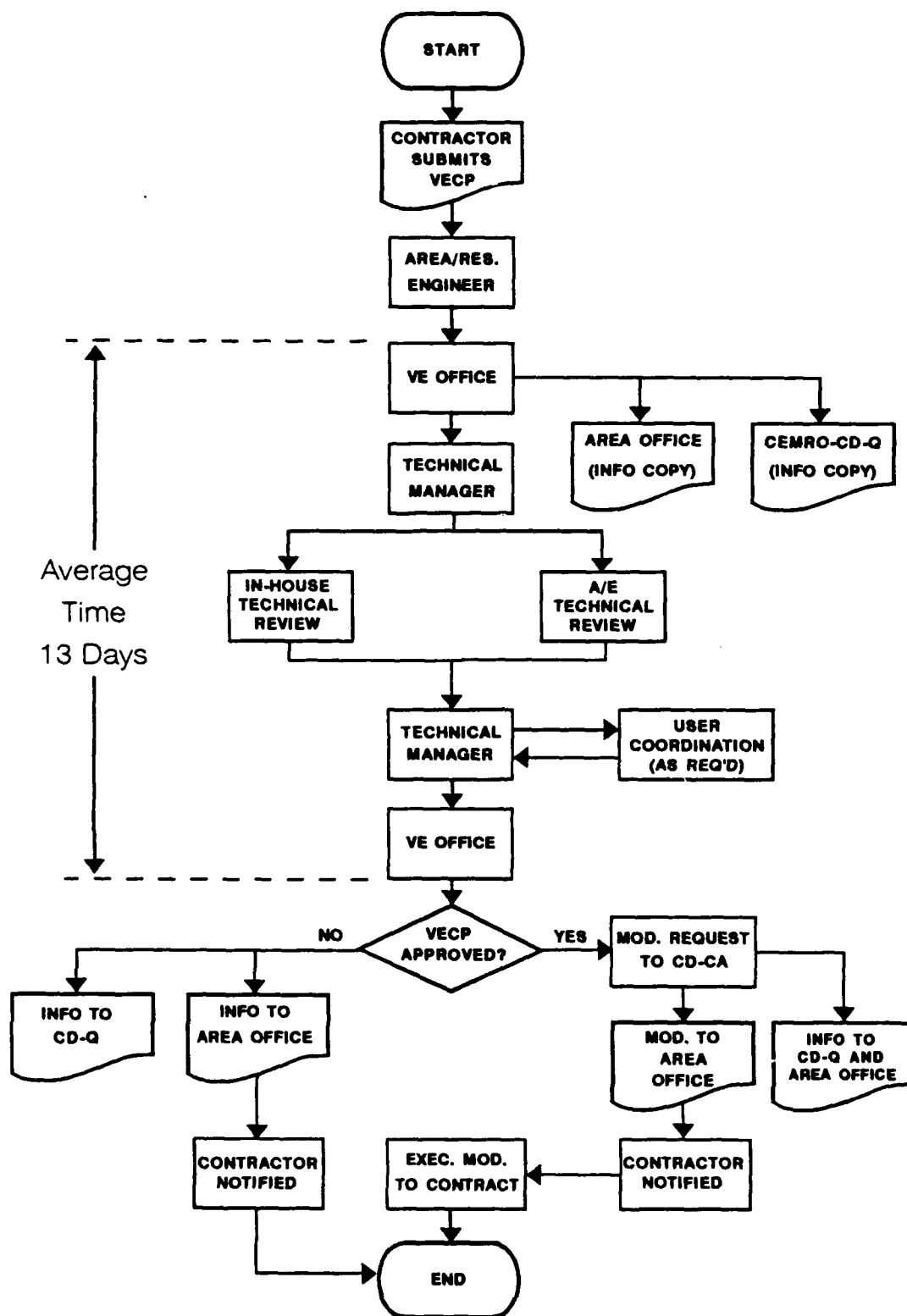


Figure 2-6. Omaha District VECP Flow Chart

optimistic estimate of this time. Therefore, under the best conditions, a contractor will not know the results of his VECP until 18 calendar days after submitting it to the Corps of Engineers. This processing time was approximately the same whether the proposal was approved or disapproved. Appendix A indicates that some VECPs took as long as 45 days while others were completed on the same day. Appendix B graphically shows the variances of the processing times of all VECPs submitted in FY 92.

Processing time of a VECP is very critical to a contractor. An interview with a contractor's Project Manager, in August 1992 revealed his frustration with the "red tape" and processing times of VECPs within the Corps of Engineers (10). Contractors must provide adequate lead times for procurement of materials and scheduling of subcontractors and work crews. The contractor normally works on a tight schedule which cannot be held up waiting for the VECP response.

CHAPTER III

PARTNERING IN THE CORPS OF ENGINEERS

What is Partnering?

Partnering is a relationship between two or more organizations for the purpose of achieving specific business goals and objectives by maximizing each participant's resources. Partnering means the establishment of non-adversarial relationships based on commitment, mutual trust, and shared visions (15). In construction, partnering is an approach that addresses the economic and technological challenges confronting the construction industry in the United States (15).

In the construction industry, the definition of partnering differs between the public and private sectors. In the private sector, the commitment of partnering normally refers to establishing a long-term commitment between organizations (15). This long-term commitment typically translates into repeat business and sole sourcing. In the public sector, sole sourcing is generally prohibited by laws and regulations such as the Federal Acquisition Regulation (FAR). Therefore, the commitment between organizations in the public partnering relationship will normally last only for the duration of the project.

Partnering is proactive in dispute resolution because different organizations work on the same team to resolve problems through a win-win approach. The win-win approach means that if the team wins, all of the organizations involved win. Even negotiations imply a "we versus they" attitude and suggests that the organizations involved have failed to prevent a possible dispute.

To actually achieve the win-win effects, individuals and their respective companies must learn to trust one another. Without the mutual trust, the partnering relationship, along with all of its benefits, will fail. Mutual trust is not easily obtained, especially since many of the former relationships were adversarial. Trust is earned when one's actions are consistent with one's words (8). It is for this reason that the element of trust will govern the speed of the implementation process of partnering within the construction industry.

Along with commitment and trust, the partnering organizations must determine their shared visions or common goals for the project. By pooling the resources of the partnering organizations to address a common goal, other benefits such as synergy will be achieved (15). Figure 3-1 shows a typical diagram of how goals are similar between the Corps of Engineers and a construction contractor (13). Although the goals and objectives have always been similar, the individual organizations were constantly focused on what was best for them.

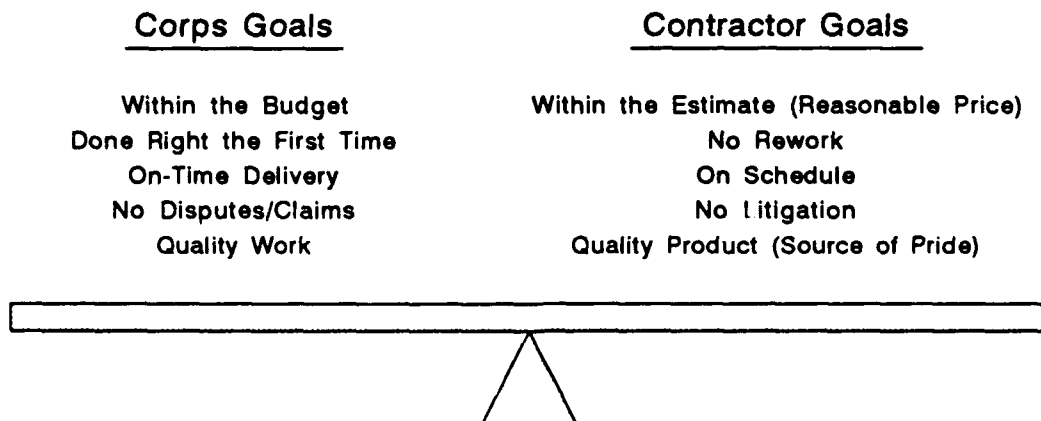


Figure 3-1. Common Goals

Why Partnering?

According to the Corps of Engineers, "The adversarial relationship between owners and construction contractors creates an environment which jeopardizes the success of the construction industry as a whole" (13). Litigation, rework, and misunderstandings have contributed significantly to the rising costs of construction. The root of adversarial relationships is the independent decision making process along with the lack of trust and poor communication between parties (13).

Owners and contractors should focus on their ultimate goals rather than concentrating on potential conflicts between themselves. Figure 3-2 is a simple diagram which illustrates how owners and contractors traditionally achieve their goal of getting a project built. Although the owner and contractor will normally achieve their goal, it will not occur without several confrontations and legal disputes. If more resources (time and money) are dedicated towards achieving the end result rather than preparing for potential conflicts with each other, the goal will be achieved with greater efficiency.

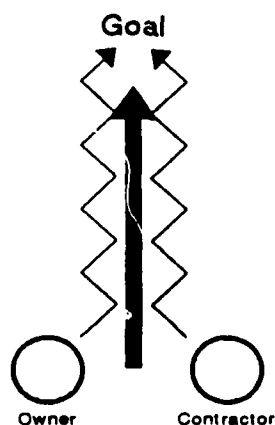


Figure 3-2. Conflicts While Obtaining Goals

Partnering will also bring additional cost savings to the owner, architect/engineer, and contractor. Many organizations, including the Corps of Engineers, have claimed substantial cost savings directly related to partnering (8). In 1988, the Construction Industry Institute (CII) conducted a survey of owners and construction contractors which indicated an estimated total project cost reduction of eight percent, improved contractor profitability of ten percent, and a schedule improvement of seven percent due to partnering (15). One of the primary reasons for this is that each organization incurs lower administrative costs due to the elimination of defense case building (15). On partnered projects, the cost savings potential of partnering may therefore determine whether the project will be a success or failure to both the owner or contractor.

Partnering will also increase the overall quality of a project while increasing safety at the construction site. In the previously cited CII survey, results show that 90 percent of the respondents claimed they had improved safety on the job, while 96 percent claimed to have improved quality (15). Although some of these estimates may appear to be subjective, some tangible comparisons can be made by comparing project safety data and the amount of rework performed to historical data.

The direct benefits, coupled with the lack of adversarial relationships, are the primary reasons for partnering in the construction industry. The Associated General Contractors of America (AGC) endorses partnering by referring to it as a concept which goes back to the way people used to do business when people's word was their bond and people accepted responsibility (1).

The History of Partnering in the
Corps of Engineers

Partnering is a derivative or byproduct of Total Quality Management (TQM). In fact, the Partnering Task Force of CII states that partnering is an excellent vehicle for attaining TQM in the construction process (15).

Partnering first started in the construction industry in 1984 with a partnering relationship between Shell Oil and SIP Engineering (15). Soon afterwards, industry giants like Fluor Daniel, DuPont, and Bechtel began partnering (15). These partnering relationships were responsible for setting the foundation for partnering in public sector construction.

Partnering began in the Corps of Engineers (and in the public sector) in the Mobile District in 1988 (8). The process began when Dan Burns, Chief of Construction of the Mobile District, offered FRU-CON Construction Corporation the opportunity to partner on a \$110 million replacement of the Oliver Lock and Dam near Tuscaloosa, Alabama. Dan Burns had studied partnering relationships in the private sector and felt that it could be adapted to the public sector. Private companies like Fluor Daniel and Dupont offered their experience and lessons learned to the Mobile District (8).

Early in 1989, the Portland District also started to partner on the replacement of the navigation lock at the Bonneville Dam on the Columbia River (8). By its completion date in 1993, this project will have utilized five major contractors with overlapping schedules. Due to the complexity of the project, the Portland District Commander, COL Charles Cowan, felt it would be an excellent opportunity to implement partnering (8). To date, the success of the Bonneville Dam Navigation Lock project

is well documented (8). The first phase of the project, the \$34 million construction of the diaphragm walls, resulted in (8):

1. No outstanding claims or litigation
2. Value engineering (VECP) savings of \$1.8 million on this \$34 million phase of construction. This savings could be compared with the VE savings of \$750,000 on a previous \$310 million contract for the construction of a second power house at the Bonneville Dam (a non-partnered project).
3. The cost growth of the project was held to 3.3% compared with the usual 10% on major projects.
4. The project was completed on schedule.
5. No lost-time injuries were suffered on the project.
6. Relative to other projects, results showed a reduction of two-thirds in letters and case building paperwork.

Because of the success of earlier efforts, partnering is currently practiced throughout the Corps of Engineers (8).

Observed Problems of Partnering

Partnering is not a panacea. Although partnering has many benefits, problems may occur during the implementation of partnering. In recent research interviews, several problems were identified with the partnering process within the Omaha District (10). The most significant problem was the lack of training and education. Problems such as misunderstandings, skepticism, misconceptions, and distrust could have been eliminated or significantly reduced through proper education or training.

Depending on the project, the initial partnering session of a project usually includes a brief discussion on partnering and its overall philosophy. Although this information proves to be very valuable, it does not give adequate information on the partnering process. This lack of information results in many people within the Omaha District placing

telephone calls to individuals in the Mobile and Portland Districts to gather more information on partnering.

As with managing any new innovation, other factors will influence the implementation process of partnering. Effective partnering will not occur overnight even with the best education and training program. Changing the attitudes and perceptions of individuals will take a significant amount of time. Furthermore, organizations might have to develop new procedures or possibly restructure their offices to accommodate the partnering process. Organizations must anticipate and address potential problems to speed the implementation of partnering.

It is important to note that partnering is affected by the personalities within the organization. When dealing with individual personalities, care must be taken not to offend anyone. For example, some personnel may be offended by the implementation of partnering. Many people have made a career of adversarial relationships with other organizations (as with claims negotiators) and the introduction of partnering suggests that what they have been doing over the years is wrong. When this occurs, these same people may become defensive and generally adversarial to the concept of partnering (10).

Partnering Workshops

The partnering workshop normally marks the beginning of the partnering relationship. The workshop begins shortly after the construction contract is awarded and before actual construction begins.

The purpose of a partnering workshop is to foster mutual respect and trust between the participating organizations and to align the goals of these organizations (8). Goal alignment is necessary to insure that all individuals and organizations in the relationship are striving to achieve

the same results. Likewise, the process of striving towards the same goals gives the participants the sense of being on the same team.

The Corps of Engineers recommends the use of a neutral facilitator for these workshops (8). Depending on the size of the project, it may be a professional facilitator who is hired by the organizations or an in-house facilitator from one of the participating organizations. When using an in-house facilitator, it is important to insure that the facilitator has no involvement with the project (8).

The size of the project usually dictates the duration and the resources spent on the partnering workshop. A partnering workshop may take anywhere from several hours to several days to conduct depending on the complexity of the project. On the average, an initial partnering workshop will take approximately one or two days. If the project is large and is scheduled to take several years to complete, several interim partnering workshops may be required to realign any goals and to reestablish any problems affecting the teamwork of the relationship. Appendix C details a generic partnering workshop recommended by the Associated General Contractors of America (1).

At the conclusion of a partnering workshop, a partnering charter is normally signed. Although the partnering charter has no legal influence, it does have people give their word that they will attempt to achieve certain specific goals. The goals found in the partnering charter may vary depending on the project. However, some of the common goals found in a partnering charter are (8):

1. Meet the design intent.
2. Encourage the maximum amount of VE savings.
3. Limit cost growth.

4. Cause no impacts to follow-on projects.
5. Lose no time due to job related injuries.
6. Encourage a fair sharing of contract risks.
7. Avoid litigation.
8. Finish ahead of schedule.

These goals, which make up the implementation plan (8), should be measurable and very specific in detail. An example of a goal within an implementation plan may be to limit cost growth by a specific percentage of the contract price or to obtain a certain amount of VECs or VE savings.

Partnering and the Contract for Projects
Within the Corps of Engineers

For partnering projects, the only change in the Corps of Engineers' solicitation to bid is the addition of a partnering clause which will encourage partnering on the project. It is important to note that an organization cannot be forced into a partnering relationship. All participation must be willing and voluntary. In the Corps of Engineers, a sample partnering clause would look like this (8):

"In order to complete this contract most beneficially for both parties, the Government proposes to form a Partnering relationship with the Contractor. This Partnering relationship will draw on the strengths of each party in an effort to achieve a quality project done right the first time, within budget and on schedule. The Partnering relationship will be bilateral and participation will be totally voluntary. Any costs associated with Partnering will be shared equally with no change in contract price."

Although partnering may change the working environment, partnering does not change the legal contract between the parties. Prices, specifications, and schedules must be met whether a project is partnered or not.

Implementing Partnering

Since partnering is a derivative of Total Quality Management (TQM), the process of effectively implementing partnering is similar to that of implementing TQM. In June 1992, CII published "Guidelines for Implementing Total Quality Management in the Engineering and Construction Industry," which presents a "roadmap" for organizations to follow while implementing Total Quality Management (14).

Partnering must follow a similar roadmap if it is to be implemented efficiently. Some of the basic requirements for implementing partnering are:

1. Sound Strategic Planning. An organization must be willing to devote resources towards planning the implementation of partnering.
2. Proper Education and Training. Individuals must be educated on new ideas if they are going to be implemented efficiently.
3. Commitment from the Top Management. Top management must genuinely commit, and stay committed, to the partnering process.
4. Partnering Workshops and Goal Alignment. This insures that all partners are striving to achieve the same results. This may also include interim partnering workshops if necessary.
5. A "Partnering Champion". The "Partnering Champion" is an individual within an organization, normally at the operational level, who is responsible for providing a favorable environment for partnering to grow (8).

Including these five basic requirements in the implementation process will better the chances of a successful partnering program.

Partnering is a concept which has affected the entire Corps of Engineers. On February 18, 1992, Lieutenant General H.J. Hatch, Commander of the U.S. Army Corps of Engineers, published a policy memorandum clearly stating the Corps of Engineers' policy on partnering (Appendix D). Highlighted in this policy memorandum was the sentence:

Therefore, it is the clear policy of the Corps of Engineers to develop, promote and practice partnering on all construction contracts, and to universally apply the concept to all other relationships.

In general, the concepts of partnering (mutual trust, teamwork, the lack of adversarial relationships) will not change the work that is performed by the Corps of Engineers, but rather how the work will be performed.

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CHAPTER IV

ALIGNING VALUE ENGINEERING TO PARTNERING

The Need for Alignment

Dr. W. Edwards Deming, one of the most widely renowned consultants on Total Quality Management (TQM), believes that processes must be brought under control and changed if the quality of products and services are to be increased (5). As previously stated, partnering provides the Corps of Engineers with an excellent vehicle to change processes within the organization and to attain TQM within the Corps. Through partnering, processes change and the Corps of Engineers will be able to provide a better service to the government at a reduced cost (8).

It is interesting to note that many of the tools and concepts of Value Engineering (VE) have been prevalent long before partnering existed. Both VE and partnering stress the importance of solving problems through teamwork. Additionally, factors such as individual personalities and other human relations play an important role in the success of value engineering. Deming also states that all organizations must continually seek to improve their products or services (5). Value engineering, in itself, is a process which seeks to improve the project by changing the design or construction process. Value engineering also focuses on the needs of the customer/user to produce a project with more value. Although there are several similarities between partnering and VE, the construction contractor's participation in the Corps' Value Engineering Program (specifically the VECP system) could be improved and aligned closer to the concepts of partnering.

As previously seen, the construction contractor's only participation in the Corps' Value Engineering Program is by submitting a Value Engineering Change Proposal (VECP). In this process, the contractor normally develops his ideas without the assistance of any external organizations (with the possible exception of a material supplier or subcontractor). The contractor then submits his ideas in the form of a VECP and hopes that it will meet the approval of the Corps of Engineers, the A/E (when necessary), and the end user/customer. The process of submitting a VECP to the Corps appears to be impersonal with little communication and interaction among organizations required.

Prior to partnering in the Corps of Engineers, the VECP process may have been an adequate method for obtaining better value in a project since many adversarial relationships were prevalent between the Corps and construction contractors. Today, individuals from both the Corps of Engineers and contractors are working closer than ever before. Partnering has broken down many barriers between the Corps and contractors and opened new avenues for continuous improvement.

Recommendations for Change

Although any VECP that is approved is a positive impact on both the Corps of Engineers and the contractor, the current system in place has much room for improvement. The following recommendations are given to enhance value engineering within the Omaha District.

1. Continue to conduct the VE Study early in the design phase of the project. This will still ensure the maximum influence over the total project costs.
2. After the construction contract is awarded, form a Value Engineering Team which will include representatives from the following areas:

- a. The Omaha VE Office
 - b. The Construction Contractor
 - c. The Omaha Technical Manager
 - d. The A/E Firm
 - e. The Customer or User
3. Conduct a VE Mini-Study (approximately 3 days in length) with the VE Team shortly after the construction contract is awarded. Make available the results of the previous VE Study to all team members.
 4. Have the VE Officer (or representative) facilitate the VE Mini-Study. Whenever possible, conduct the VE Mini-Study near the project site.
 5. Present the findings to the Area Engineer (and other involved personnel) at the end of the VE Mini-Study. If possible, issue the VECP acceptance memorandums (NTP) at the local Area Office.
 6. Fund any costs associated with bringing the team together (travel, per diem, time) as a VE developmental cost.
 7. After developmental costs are deducted, the remainder of the VECP savings are split as usual (45% - 55%).
 8. Include a VE Office representative (if available) in the partnering sessions of major projects. The VE Officer needs to be familiar with the project's goals and objectives prior to facilitating the VE Mini-Study.

These recommendations were developed by the author by applying the concepts of partnering (teamwork, trust, achieving common goals) to the VECP process. Personal interviews conducted with members of the Omaha District and some of their contractors in August 1992 greatly influenced the recommendations (10). These recommendations were further refined through close coordination with Steve Moore, Value Engineering Officer of the Omaha District, and other key individuals from the U.S. Army Corps of Engineers.

The Value Engineering Mini-Study

The majority of the VE Mini-Study will consist of a new VE Job Plan. The new VE Job Plan will take the same systematic approach (using the five phases) as the original job plan. FAST may also be useful when conducting a VE Mini-Study. Obviously, the key difference here is the addition of the construction contractor as a team member.

With the addition of the contractor, the VE Mini-Study will facilitate the integration of the project team and the various stages of the construction process. Furthermore, the VE Mini-Study will align the project closer to the concepts of constructability as recommended by the Construction Industry Institute (3):

Industry tends to separate the individual functions involved in capital projects. Design tends to place emphasis on minimizing its costs. Construction focuses on minimizing field costs. Fine-tuning the individual parts, however, does not yield the most successful project. Constructability integrates these parts and is one of the most powerful tools owners can use on their projects.

The VE Team will consider, discuss, and analyze all ideas brought out during the job plan. Since the construction contractor is present for the first time, many of the ideas may come from him. More than likely, the contractor will present his ideas based on his past construction experiences. However, all team members will be expected to participate in the generation of ideas. The focus of the team needs to be on the project and not on any one individual or organization.

While conducting the VE Mini-Study, if technical assistance is required during the Analysis or Development Phases, the team should attempt to get the assistance through all available means. This may include using the engineers located in each Area Office, calling an engineer in Omaha, or by faxing information. If the team cannot get the

required assistance during the VE Mini-Study, the VE Officer should then take the responsibility to insure that the proposal receives the appropriate assistance after the conclusion of the VE Mini-Study. Liability for redesign and contract performance would continue to rest with the contractor as it does under the VECP system.

The fifth phase of the job plan (the Presentation Phase) may be delayed until all ideas are fully developed. At the end of the VE Mini-Study, the team can brief the Area Engineer on their recommendations. Other personnel interested in the project (Resident Engineers, special staff, other personnel from the contractor) should attend this briefing. The Area Engineer could then accept the VE Team's recommendations by issuing a Notice to Proceed (NTP) when the estimated accumulated savings are less than \$100,000 (the Contracting Officer's Representative dollar limitation in the Omaha District). If the estimated savings are greater than \$100,000, then the VE Officer would have to get the Contracting Officer to issue the NTP. The NTP will give the contractor the authority to proceed with the change even though a detailed estimate and contract modification have not been issued (7). Any proposal which is fully developed must have the consensus of all of the VE Team members before it is presented to the Contracting Officer or his representative (Area Engineers).

The VE Mini-Study can also include other activities. These activities may be a brief project site visit, team building exercises, and a brief discussion of how to encourage creative thinking. Appendix E, which shows a generic agenda for a VE Mini-Study, is provided as a guide. The VE Office would develop the actual agenda for a VE Mini-Study on the specific project and should publish it in advance to all team members.

Costs of the VE Mini-Study

There are direct costs associated with the VE Mini-Study. First, there are the actual costs associated with bringing the VE Team together (i.e.- travel, lodging, per diem, and other expenses). Second, there are the costs associated with pulling employees away from their daily responsibilities (salaries) to attend the VE Mini-Study. Since the Corps of Engineers and contractors normally charge time to particular projects, both of these costs should be absorbed as a value engineering developmental cost. All parties and team members involved must be willing to participate in the VE Mini-Study.

An example of deducting the developmental cost is shown in Table 4-1. The actual costs depends on the number of participants involved with the VE Mini-Study. Obviously, there is no guarantee that a VE Mini-Study will produce any cost savings. In the event that the VE Mini-Study produces a savings less than the developmental cost, the savings produced (if any) would then be split and the construction contractor would be liable for only the travel expenses and the A/E salary. An example of this is seen in Table 4-2.

Since the construction contractor stands to gain the greater profit from the VE Mini-Study, he should, in the author's opinion, assume the liability for the travel expenses and the A/E's salary. The A/E must be compensated for his time since he will not gain any direct monetary benefits from the VE Mini-Study. Therefore, it is critical that the construction contractor carefully weigh the advantages and disadvantages before agreeing to a VE Mini-Study. The contractor must also consider his normal VE developmental costs (both time and money) under the current VECP system.

Table 4-1. Sample Calculations for Determining the Actual Savings when the Savings Produced Exceeds the Developmental Costs

Travel, Lodging & Per diem of all VE Team Members	\$ 2124.00
A/E Salary	\$ 1200.00
Corps of Engineers' Salaries	\$ 9000.00
Contractor's Salaries	+ \$ 3000.00
VE Developmental Costs =>	\$15,324.00
Savings Produced by the VE Mini-Study	\$53,746.00
VE Developmental Cost	- \$15,324.00
Total Actual Savings* =>	\$38,422.00

*The Total Actual Savings would then be split as a VECP with the traditional 45% to 55% (Corps to Contractor respectively) ratios.

Table 4-2. Sample Calculations When the Actual Savings are Less Than the Developmental Costs

Travel, Lodging & Per diem of all VE Team Members	\$ 2124.00
A/E Salary	\$ 1200.00
Corps of Engineers' Salaries	\$ 9000.00
Contractor's Salaries	+ \$ 3000.00
VE Developmental Costs =>	\$15,324.00
Savings Produced by the VE Mini-Study	\$ 7000.00
45% for the Corps of Engineers	\$ 3150.00
55% for the Contractor**	\$ 3850.00

**The Contractor must then pay for the travel expenses and the A/E salary (\$3,324.00 in this example).

Advantages and Disadvantages of a Mini-Study

All parties must carefully consider the potential advantages and disadvantages of conducting a VE Mini-Study, which are summarized in Table 4-3. The actual advantages and disadvantages will depend on the creativity and the group dynamics of the VE Team and the type of project under consideration.

Money (costs and profits) is a criterion which is often critical to the decision making process within the construction industry. With the VE Mini-Study, there exists the potential to achieve greater cost savings since all team members are striving to meet the user's needs at the lowest life cycle costs. On the other hand, the initial costs of bringing the team together (developmental costs) are much greater which will reduce the actual (net) savings. Furthermore, the contractor assumes the risk of covering a portion of the team's travel expenses if the savings produced by the VE Mini-Study is less than the developmental costs.

Time is also critical in the construction process. By conducting a VE Mini-Study, the contractor would receive immediate feedback whether or not the proposal will be accepted by the Corps of Engineers. This immediate feedback could provide the contractor with the adequate lead times to procure the necessary materials. However, the contractor may find it difficult to dedicate one of his key individuals to the mini-study for three days. During the mobilization of the construction phase, the contractor must insure that he gets the right people, materials, and equipment to the job site. The contractor's project manager may have to decide whether it is more important to attend a mini-study or to insure the mobilization process runs smoothly.

Table 4-3. Advantages and Disadvantages of a VE Mini-Study

Topic	Advantages	Disadvantages
Dollars	<ul style="list-style-type: none"> - Greater potential savings for the government and contractor 	<ul style="list-style-type: none"> - Costs and therefore risk to the contractor in agreeing to a mini-study (both personnel time and money)
Time	<ul style="list-style-type: none"> - The contractor will receive a quicker response from the Corps on the proposals 	<ul style="list-style-type: none"> - 3 days for a contractor to dedicate a key individual during the mobilization phase of a project may difficult
Team Dynamics	<ul style="list-style-type: none"> - Using a systematic approach for developing creative ideas - Team brainstorming and synergy - Enhanced professional relationships among all parties - Learning (professional development) from other ideas and professionals 	<ul style="list-style-type: none"> - Difficulty reaching consensus on a proposal - Developing ideas as a team may be slower than an individual's developmental process - A/E may be defensive with respect to his design
Communication	<ul style="list-style-type: none"> - Developing and presenting ideas in person as opposed to a written form - Clearer understanding of proposals and ideas - The end user/customer will understand and obtain a project which better satisfies his needs 	
Approval Process	<ul style="list-style-type: none"> - Reduced disapproval rates of the proposals since all parties play a role in the development of the idea - More proposals will be presented 	

Teamwork may bring several advantages and disadvantages to any problem solving process (the problem of meeting the user's needs at the lowest cost). Different viewpoints and experiences of the individual team members will provide for a greater spectrum of creativity. Moreover, teamwork will enhance the professional relationship between the team members while allowing them to learn from each other. On the negative side of teamwork, reaching a consensus among the team members may be difficult. This also means that the team process may take longer to develop the ideas as compared to developing ideas on an individual basis. Also, one other important negative impact may be that the A/E may be very defensive in his design and may not like the idea of others criticizing his design. If the A/E becomes defensive, he may isolate himself from the rest of the team and reduce the efficiency of the team.

In value engineering, it is critical for all members to understand the proposed ideas and changes (4). The contractor would have the opportunity to "sell" his ideas in person rather than trying to convince the same individuals in the written format of a VECP. By conducting a VE Mini-Study, the team members would be able to convey their thoughts in person rather than having to do it on paper. The VE Mini-Study would also allow for immediate questions if an idea presented was not clearly understood.

The VE Mini-Study should also increase the approval rate of the VECP system since all team members would play a role in the development. This would result in more time being spent on good ideas (those that are more likely to be approved) and less time would be spent on those ideas that would be disapproved. Furthermore, it is anticipated that more VECPs would be generated from the VE Mini-Study. Often, a contractor will not

bother with the expense of putting together a VECP submittal if he is not sure it will get approved or if the potential savings are very small. The VE Mini-Study would allow the contractor to present several of his smaller VECPs without having to go to the expense of putting an entire VECP submittal together. The cumulative savings produced by several smaller VECPs could be substantial.

All parties involved must agree to the conducting of a VE Mini-Study. However, the advantages of a VE Mini-Study will exceed its disadvantages for many projects. By capitalizing on the advantages, both the Government and the contractor may receive substantial savings and profits.

CHAPTER V

VALIDATIONS

Methodology

The best manner to validate the feasibility and cost effectiveness of a VE Mini-study would be to actually conduct several VE Mini-Studies and analyze their results. This was not possible due to time constraints. Therefore, the validation procedure was revised to analyze, through a series of questionnaires, the opinions of the construction contractors and the Corps of Engineers about the validity and applicability of a VE Mini-Study.

Before conducting any surveys, a proposal was developed to clearly justify the need for increasing the contractor's participation in the Corps of Engineers' Value Engineering Program. The proposal also introduced the VE Mini-Study as a means for increasing the contractor's participation. Generally, this proposal was a condensed version (22 pages) of the information presented in Chapters I through IV of this thesis. The proposal was developed under the technical guidance of Steve Moore, Value Engineering Officer of the Omaha District. Eventually, the Deputy Commander of the Omaha District, LTC James S. Weller, liked the ideas in the proposal and gave permission for its distribution to contractors who typically perform work for the Omaha District.

The Contracting Division of the Omaha District provided a list of 48 general contracting companies that traditionally perform work within the district. These companies, along with their addresses, are included in Appendix I. Specific points of contact were not available. All 48

companies were sent a proposal packet consisting of a copy of the proposal, a letter from LTC Weller, and a brief questionnaire (See Appendix F). The purpose of the questionnaire was to obtain the opinions of the contractors on the present VECF process and the proposed VE Mini-Study.

Of the 45 contractors who received proposal packets, 15 contractors (33.3%) responded. The Postal Service returned three of the packets with "Return to Sender." Initial analysis of the responses indicated a wide variability of answers (a detailed analysis of the responses is conducted later). Most of the contractors provided comments establishing conditions (criteria) for when they felt a VE Mini-Study would be warranted.

A second questionnaire (Appendix G) was sent to the responding contractors to obtain general information about their companies and their partnering relationship with the Corps of Engineers. Since two of the responding contractors were anonymous (they did not provide any company name or point of contact), only 13 contractors were sent the second questionnaire. This questionnaire focused on the companies' partnering experiences and the profiles (size and type of work performed).

A third questionnaire was sent to key individuals within the Corps of Engineers (Appendix H). The purpose of this survey was to capture the knowledge of several experts who are familiar with the value engineering process. The focus of the survey was to develop further the criteria required for the VE Mini-Study. This survey also addressed some of the questions the contractors asked in their responses to their initial survey.

Although the information collected in the surveys is not conclusive, it does indicate the trends and opinions of general contractors and the

Corps of Engineers. The information provided meets the objectives of the research by establishing a general need for improvement, the feasibility of conducting a VE Mini-Study, and the conditions (criteria) for when a VE Mini-Study can provide significant cost savings.

Analysis of the Responses

The Contractor's Initial Survey

Appendix F shows a copy of the initial questionnaire, along with a letter from LTC Weller, sent to the contractors. Appendix F also gives a consolidation of the responses from the contractors. Questions 1 through 6 focused on obtaining the contractor's opinion of the present VECP system. Questions 7 through 13 were designed to obtain their opinion of the proposed VE Mini-Study.

When the contractors were asked to rate the overall effectiveness of the current VECP system within the Corps of Engineers (Question 1), the majority rated it as "fair" or "poor." However, when asked to rate the VECP system in terms of providing mutual cost savings (Question 2), the majority rated it as "good" or "excellent." This indicates that although the contractors thought the VECP system provided a good opportunity to provide them with mutual cost savings, the overall system could be made more effective. Figure 5-1 graphically presents the contractor's responses.

The contractors also thought that the time to get the VECP results back from the Corps of Engineers (approval/disapproval) should be substantially improved. When asked what was the average response time to receive an answer on a submitted VECP (Question 3), the average response was 34.9 days. When asked what they felt was a reasonable time the

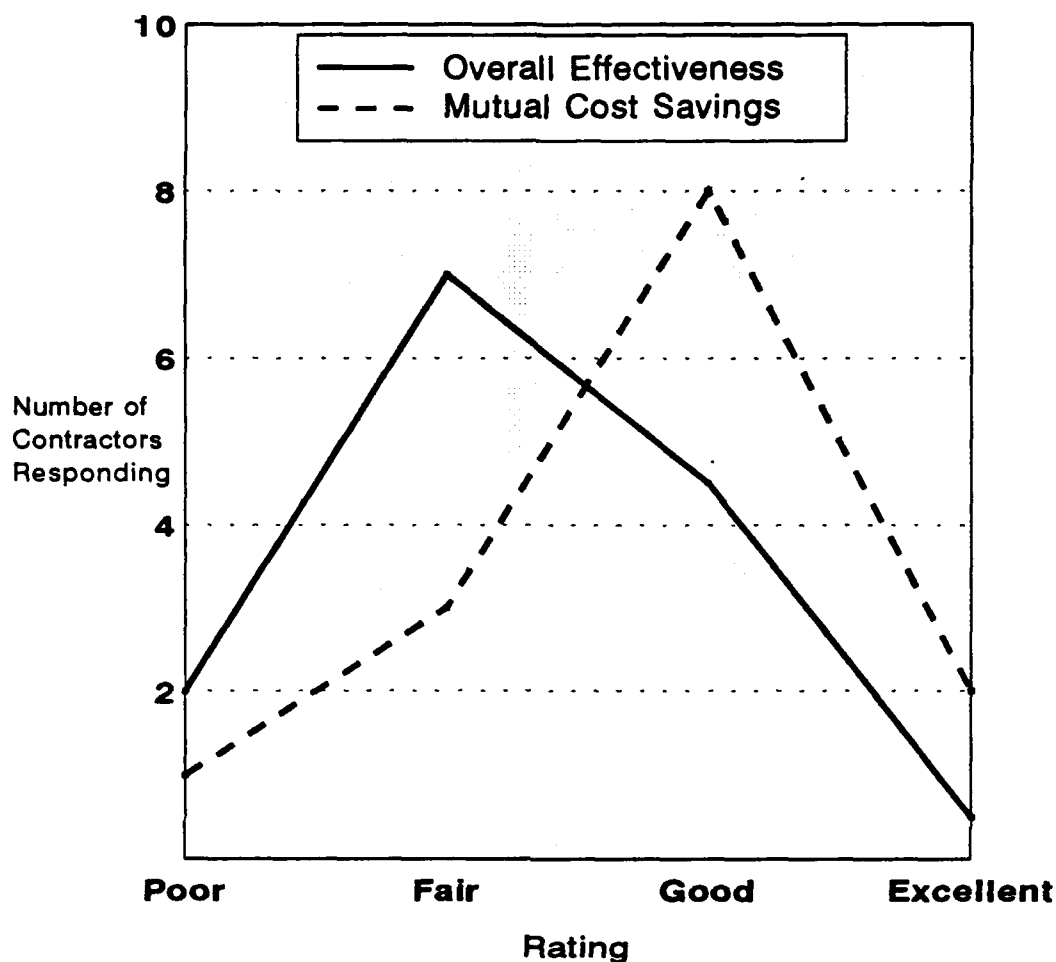


Figure 5-1. Contractors' Rating of the Present VECP System

Corps of Engineers should take to get them results of a submitted VECP (Question 4), the average response was approximately half that, or 17.8 days.

As shown earlier in Chapter II, the processing time for the VECPs in the Omaha District Value Engineering Office in 1992 averaged 13 calendar days. A optimistic estimate of five days was given to receive and distribute the VECP (totalling 18 days). Since contractors claim that it

takes an average time of 35 days, this indicates that the five day estimate was more than likely too optimistic. Also, the contractor's perception of 35 days may also be a slight exaggeration of the actual processing times. Another critical note that could explain the discrepancy is the fact that the average processing times from the FY 92 data were averaged per VECP submittal and not per contractor.

Questions 5 and 6 drew mixed responses. The contractors were asked whether or not they felt the present VECP system was well aligned to the concepts of partnering. Sixty-one percent of the contractors disagreed while 39% agreed. This response is an indicator of the need to align the present VECP process to the partnering concept. Furthermore, a majority of the contractors (57%) were surprised about the historical data of those VECPs submitted in FY 1992. While not displaying certain trends, this does show that a majority of the contractors felt that the present VECP system could be better aligned to the concepts of partnering.

The contractors were generally open to the idea of working on a team with the user, A/E, and the Corps of Engineers to develop VE proposals (Question 7). Two-thirds of the contractors said it would be "more" or "much more" productive than the current VECP system. Twelve (80%) of the respondents also felt that the VE Job Plan was a "good" or "excellent" approach for identifying areas of savings while maintaining or increasing the value of the project (Question 8). The VE Job Plan also requires the contractor to think about submitting VECPs in the early phase of construction (i.e.- mobilization) rather than submitting them as the construction progresses. One contractor commented to Question 8 with "Due to engineering time and material procurement, will be most effective at (the) job start, not later on."

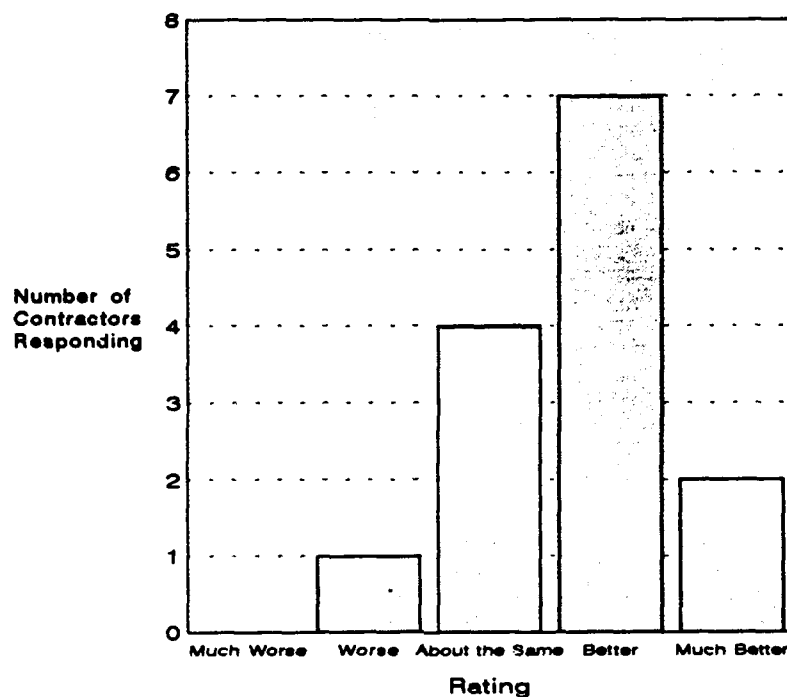


Figure 5-2. Contractors' Rating of the VE Mini-Study Compared with the Current VECP System.

Figure 5-2 shows the contractor's ratings of the proposal to conduct VE Mini-Studies as compared to the present VECP system (Question 9). Although these responses appear to be favorable, they also indicate that the VE Mini-Study could use some improvement. Some contractors went further to state that the VE Mini-Study may not be applicable in all projects and in all situations. For example, the VE Mini-Study may not be very cost effective for smaller projects since the developmental costs are greater. The results also indicate that although the VE Mini-Study may be a step in the right direction, it may require improvements before a VE Mini-Study can be conducted. One area of the VE Mini-Study that received mixed comments (and suggestions of improvement) was the recommended expenses of conducting a VE Mini-Study.

Question 10 specifically asked the contractors if the expenses of the VE Mini-Study should be absorbed as recommended. Seven (one half) of the responding contractors said "No." Some contractors did not like the idea of paying the expenses for the A/E. Others felt the Corps of Engineers could assume more of the risk (expenses) of bringing the VE Team together. Most of the contractors recognized the fact that all of the expenses would be subtracted from the savings generated by the VE Mini-Study, but they also recognized the possibility that the VE Mini-Study might not generate enough savings to cover the developmental costs.

Question 11 was designed to give the contractor an opportunity to request more information on VE within the Corps of Engineers. Those who said they would like more information were sent a copy of a 30 page pamphlet Value Engineering in the COE (published by the Corps of Engineers).

The last two questions (12 and 13) asked the contractor about the likelihood of conducting a VE Mini-Study with the Corps in the future. Only one contractor indicated that he currently had a project that may benefit from a VE Mini-Study. After passing this information to Steve Moore, VE Officer for the Omaha District, both the Corps of Engineers and the contractor determined that the project was not well suited for the VE Mini-Study. However, when asked if they would be interested in conducting a VE Mini-Study with the Corps of Engineers, twelve (80%) said they would be interested. This is a very good indication that contractors are willing to try new approaches given the right circumstances.

When asked to provide any additional comments, several contractors said that the recommended three day duration of the VE Mini-Study was too long. These contractors were hesitant to dedicate a key individual to a

VE Mini-Study for three days (not including a possible two day partnering session) during the mobilization phase of a project. Another contractor emphasized that strong coordination must occur between the contractor and the Corps of Engineers prior to the VE Mini-Study if it is to be successful.

The Contractor's Second Survey

Appendix G shows the Contractor's Second Survey along with a consolidation of their responses. As mentioned before, the objective of this survey was to obtain further information from those contractors responding to the first survey. The questions focused on documenting their partnering experiences and obtaining a profile of the construction companies. This information was needed to determine if there was any correlation between the contractor's partnering experiences and the responses on the first questionnaire. The second questionnaire was also used to determine if the size of the construction company had any effect on their responses on the first questionnaire.

Since the partnering concept was instrumental in the development of the proposal, Questions 1 and 2 asked the contractors about their partnering experiences with the Corps of Engineers. A majority (62%) of the contractors said they are currently partnering, or have partnered, on a project with the Corps of Engineers. Of those contractors with partnering experience, eight of the nine contractors rated their partnering experiences as either "good" or "excellent." The one contractor who rated his partnering experience as "fair" was also one of two contractors who said that he was not interested in conducting a VE Mini-Study in the future (Question 13 of the Initial Questionnaire). The other contractor had no partnering experience at all with the Corps.

The third question was an attempt to see if the type of work normally performed by the contractor had any effect on the responses of the first survey. After close investigation, no correlation could be made from the information provided and their responses on the first survey. Two contractors responding almost identically to this question gave opposing responses in the first questionnaire.

The last questions (4, 5 and 6) categorized the size of the companies in terms of the amount of work performed in annual construction dollars. Figure 5-3 shows that the responses came from some of the largest construction companies to some very small companies. Once again, no correlation could be made from these responses. Although a relatively small number of contractors responded to the first questionnaire, Figure 5-3 shows a good distribution of contractors (in terms of dollar volume per year).

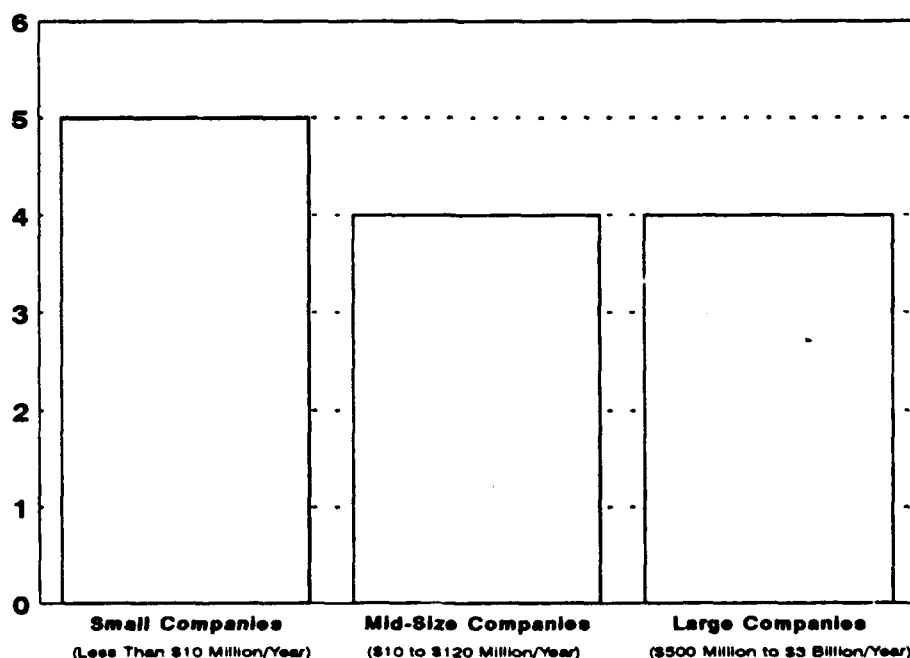


Figure 5-3. Size of Construction Companies Responding to the Surveys

The second contractor's questionnaire indicated that the partnering experiences of the contractor may have had an effect on their responses to the first questionnaire. Those who had good partnering relations with the Corps were interested in doing a VE Mini-Study. The second questionnaire also indicated that the size of a company or the work normally performed by the company had no effect on the responses of the first questionnaire. The overall reason why certain contractors responded in the way they did may lie within the comment provided by a Project Manager for EBASCO/NEWBERG, on a very large project in Tennessee:

You make reference to the goal of determining with the questionnaire why certain GCs [General Contractors] are favorable with the proposal while others are not. I caution you not to lose sight that it is not necessarily the GC, rather it's the people involved in running the GC. If people change, the GC philosophy will/might change. Here at J-6, I have maintained that you must have the "right people" [right chemistry] to be the most successful possible. Even in my company, my philosophy of management is neither shared nor practiced by some others who manage. Same is true for the Corps of Engineers' personnel. Some can relate, others can't. Although there are many variables to the task you are pursuing, I think company classification is one of the least pertinent denominators.

The Corps of Engineers' Survey

The Corps of Engineers' Survey, along with the consolidated responses, is shown in Appendix H. Appendix I shows the names and duty positions of the seven experts (respondents) used in the survey. All seven experts surveyed responded to the questionnaire.

Six of the seven experts surveyed were already familiar with the proposal of conducting VE Mini-Studies and had provided input into its development. The one expert who was not familiar with the proposal received a copy of the proposal along with the questionnaire. The purpose of this survey was to obtain their views of what factors and conditions

would affect the success of a VE Mini-Study and to address several issues raised on the Initial Contractors' Survey.

Figure 5-4 summarizes the average responses (Question 1) dealing with the importance of criteria affecting the success of a VE Mini-Study. The project size in dollars and the end user of the project were believed to be the most important criteria, whereas the project location was thought to have little effect. This is understandable since the objective of value engineering is to meet the user's needs at the lowest cost. When asked to suggest a dollar amount for the project size, the minimum of all responses was \$2 million (which 3 respondents suggested) and the average response was \$4.3 million. The interactions of individual personalities or "having the right chemistry" was also thought to be a relatively important factor.

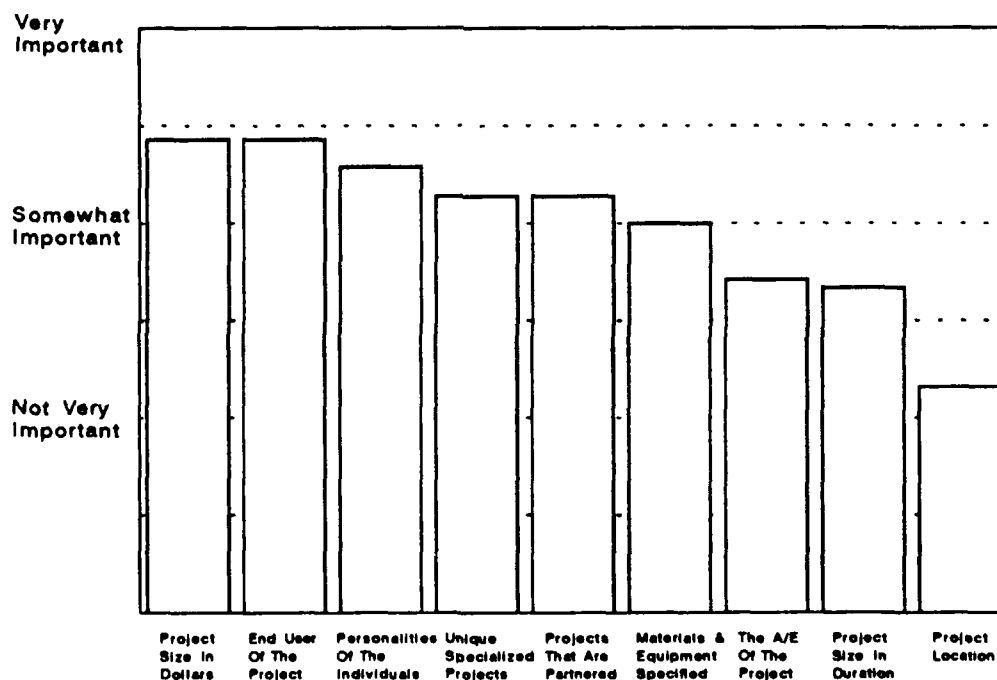


Figure 5-4. Responses of the Importance of Criteria Affecting the Success of a VE Mini-Study

Since some contractors did not like the idea of including (and paying for) the A/E, a question was asked of the Corps of Engineers if the A/E was critical to the success of a VE Mini-Study (Question 2). Although some of the experts did not think it was critical, all felt the presence of the A/E would be beneficial to the VE Mini-Study.

The seven experts from the Corps of Engineers responded unanimously that the proposed three day duration of the VE Mini-Study could be reduced (Question 3). Most agreed that the VE Mini-Study could be shortened to one or two days. A shorter VE Mini-Study may also have greater appeal to the contractor since it will reduce the developmental costs and risk associated with bringing the VE Team together.

One contractor suggested that a "VECP Short Form" be developed to speed the VECP process for minor changes to the project. Additionally, the "VECP Short Form" could be used to augment the present VECP process or the VE Mini-Study. The question was asked of the Corps of Engineers if they would be in favor of creating a "VECP Short Form" for minor, non-structural items (Question 4). Most of the respondents were in favor of this idea. Some replies were: "The simpler, quicker, the better" and "Whatever can be done to eliminate paper and speed the process."

However, one reply stated that the Federal Acquisition Regulation (FAR) was explicit in submittal requirements and did not allow the creation of a "VECP Short Form." After carefully researching the FAR, no specific format or form is required. The FAR only states that the VECP must address, at a minimum, seven different topics (description, detailed cost estimates, previous submissions, etc.) (7). It is very possible that these seven topics could be included on a "VECP Short Form." This response emphasizes that the manner in which the experts interpret the regulation plays an important role in the ability to improve the process.

When asked about the Value Engineering Officer (VEO) of a district being represented at all formal partnering sessions (Question 5), the general consensus of the respondents was that he should be represented at some of the sessions, but not all. At a first glance, the responses appear to be mixed (with three responding with "yes" and four with "no"), however, some of the comments clarified the responses. Some of these responses were "Yes, (but) workload may not allow this" and "No, never say ALL - Everyone should be considering VE's all the time."

When asked if there was any way the Corps of Engineers could assume more of the risk (costs) involved with bringing the VE Mini-Study together (Question 6), five of the seven of the respondents said "Yes" and one responded with "Not Sure." The one reply of "No" stated that the FAR did not allow for such costs. The definition of "Government Costs" according to the FAR is:

"Government costs," as used in this clause, means those agency costs that result directly from developing and implementing the VECP, such as any net increases in the cost of testing, operations, maintenance, and logistic support. The term does not include the normal administrative costs of processing the VECP (7).

If the costs associated with bringing the VE Team together for a VE Mini-Study are understood as resulting "directly from the developing and implementing the VECP," then there would appear to be no regulatory constraint on the Government assuming more of the risk. If the VE Mini-Study is viewed as an administrative cost, then there may be a regulatory constraint. Once again, interpretation of the regulations plays a critical role in improving the system. Whoever assumes the risks, good communication is critical. Before conducting a VE Mini-Study, the contractor and the Corps of Engineers should agree on who will cover which of the developmental costs.

The experts from the Corps of Engineers also had some interest in increasing the participation of the contractors in their Value Engineering Program (Question 7). Some of the respondents reiterated the need to make the VECP quicker and simpler. Others suggested that the Corps of Engineers could do a better job publicizing success stories. Mr. Ted A. Dahlberg, Chief of Value Engineering for the Corps of Engineers responded by saying, "We need to publicize the 60 to 70% acceptance rate and that we have approved a number of VECPs for more than \$1 million" (Appendix H).

Summary of the Surveys Conducted

The contractors acknowledge that the present VECP system could be improved. Responses from the Corps of Engineers like, "Whatever can be done to eliminate paper and speed the process" (Appendix H), indicate that the Corps feels the VECP process can be improved. Both parties indicate that they are willing to try new approaches to increase the efficiency of the present VECP process.

The contractors generally feel the proposed VE Mini-Study is better than the present system; however, they also indicate that the VE Mini-Study could be improved. The VE Mini-Study should be shortened to one or two days (depending on the project). In addition, any risks or costs associated with bringing the VE Mini-Study together should be shared and well coordinated in advance of the VE Mini-Study.

The VE Mini-Study is not applicable to all projects and situations. There are many factors which will affect the success of a VE Mini-Study. The project size in terms of dollars, the customer of the project, and the personalities of the individuals in the VE Team are some of the most important criteria which will determine the overall success of the VE Mini-Study.

One prominent factor that was key to the responses (and will continue to remain prominent) was the emphasis placed on "soft" issues. Personalities, relationships, and communications are equally as important as (if not more important than) scheduling, estimating, and construction materials. Partnering is the concept the Corps of Engineers uses to address these soft issues. Of the two contractors who stated they were not interested in conducting a VE Mini-Study, one had no partnering experience with the Corps and the other was the only contractor to rate his partnering relationship as "fair." On the other hand, the president of a mid-sized general contractor stressed the importance of partnering. He stated:

...Working with the Corps of Engineers and the owner [the Rock Island Arsenal] in a user area was difficult. However, everyone recognized the situation and, through meetings, careful laid plans were implemented and project reality [was] accomplished. ...[Our company] strongly urges the partnering approach. ...It presents an opportunity for the contractor to suggest savings and even [obtain] a more superior product. However trust and participation by all is necessary. When these ingredients are present, a successful Value Engineering process can take place...

A VE Mini-Study will only be successful when the "soft" issues are adequately addressed. The fact that numbers or values can not be placed on "soft" issues does not make them any less important. The VE Mini-Study, along with partnering, addresses these "soft" issues and can improve the VECP process within the Corps of Engineers.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Both the Corps of Engineers and contractors will benefit from the VE Mini-Study. Through partnering, the Corps of Engineers and contractors should continually work together to improve processes and increase their efficiency.

The construction contractor has the greatest expertise in actual construction methods but currently plays a minimal role in value engineering. Value Engineering Change Proposals (VECPs) account for only 4% of the total savings generated by the Corps of Engineers' Value Engineering Program. VECPs provide the contractor the opportunity to profit from his experience and creativity while generating a project savings for the Government.

The present VECP process is viewed as slow and cumbersome by many contractors. The VECP process consists of the contractor submitting his ideas on paper to the Corps of Engineers. The VECP submittal is then routed through several offices within the Corps of Engineers where it is closely scrutinized by several individuals. On the average, it will take several weeks before the contractor receives an answer (approval or disapproval) from the Corps of Engineers. The contractors surveyed gave the overall effectiveness of the present VECP process an average rating of "fair."

Time is very critical to the contractor. Contractors need adequate lead times to procure materials and to schedule work crews. Long VECP

processing times discourage the contractor from submitting future VECs. The contractors surveyed perceived the Corps of Engineers should be able to process a VEC in about half the present time.

The present approval rate of VECs submitted within the Omaha District is 61%. When a contractor's VEC is disapproved by the Corps of Engineers, he is not compensated for his developmental costs. Any rejection of a VEC, for whatever reason, will discourage future VEC submittals.

Improvement of the present VEC process is necessary if the Corps of Engineers is to achieve a greater value (cost savings) on their projects while increasing the profits of the contractors.

Partnering has brought a new philosophy to the Corps of Engineers. As partnering continues to mature within the Corps of Engineers, efficiency will increase as the number of adversarial relationships decreases. Partnering has established the precedence for improvement of the VEC process, because both partnering and VE Studies are dependent on effective teamwork. The VE Mini-Study aligns the present VEC process closer to the partnering concept through teamwork.

"Soft" issues, such as human relationships and personalities, are very important to the success of the VE Mini-Study and should not be overlooked. Partnering within the Corps of Engineers has made significant improvements in coping with these sometimes difficult and non-tangible issues.

The proposed VE Mini-Study is a workshop where a team consisting of the contractor, A/E, customer, and members of the Corps of Engineers study the project to develop VECs. Since the VE Mini-Study involves the contractor, the team will perform the VE Mini-Study soon after the award

of the construction contract. The team will study the project using creativity and a systematic approach (VE Job Plan).

The VE Mini-Study is a tool which can increase the efficiency of the present VECP process. The proposed VE Mini-Study received generally favorable reviews from both the contractors and the Corps of Engineers. Eighty percent of the contractors surveyed stated that they would be interested in conducting a VE Mini-Study with the user, A/E, and representatives from the Corps of Engineers. Furthermore, 9 of 15 contractors stated that the proposed VE Mini-Study was either better, or much better than the present VECP process.

The proposed VE Mini-Study can be improved by reducing the duration from three days to one or two days for most projects, which would reduce the developmental costs and risks. Members of the team must coordinate and agree to any costs associated with bringing the team together (developmental costs) before conducting a VE Mini-Study. Additionally, a shorter VE Mini-Study will be less demanding on the contractor during his critical time of project mobilization. Further improvements may be identified after conducting and analyzing several VE Mini-Studies.

Recommendations

VE Mini-Studies should be implemented immediately on a test case basis. If possible, perform the VE Mini-Studies within several districts of the Corps of Engineers to obtain a more diversified database. Resident Engineers, Project Managers, and Project Engineers for the Corps of Engineers (and others having daily contact with the contractors) are the key to getting these VE Mini-Studies conducted. As a future Project Engineer/Manager for the Omaha District, the author of this thesis intends to take an active role in the testing of the VE Mini-Study. Careful

analysis should be conducted after performing several VE Mini-Studies so that continual improvements to the VE Mini-Study may be made.

Various forms of education will also improve the Corps of Engineers' Value Engineering Program. The Corps of Engineers needs to educate contractors and customers about the benefits of partnering and the VE process. As Ted Dahlberg (Chief of Value Engineering for the Corps of Engineers) stated, "We need to publicize the 60 to 70% acceptance rate and that we have approved a number of VECs for more than \$1 million." Furthermore, the Corps of Engineers must continually educate its own personnel to insure a consistent interpretation of applicable regulations (FAR).

Partnering has made an impact on the entire Corps of Engineers by providing an avenue for the Corps of Engineers to follow towards continuous improvement. The Value Engineering Program is only one small area of the Corps of Engineers to which improvements, through partnering, can be made. Other areas, such as Quality Assurance or In-House Design, should be considered for improvement within the Corps of Engineers due to this change of philosophy.

APPENDICES

Appendix AThe Omaha District's VECs Submitted
In Fiscal Year 1992

The following page reflects the VEC database file from the Omaha District's Value Engineering Office. These are all the VECs submitted by construction contractors in FY 92 (1 October 1991 to 30 September 1992). An explanation of the column headings is provided below:

FILENO -> The file number assigned by the VE office

SUBJECT -> A brief description of the VEC

PROJTITLE -> The project title

ACTN -> The action code of the VEC
1 - Approved
2 - Disapproved
3 - Partially Approved
4 - Disapproved
5 - Disapproved

DATEASSD -> The date the VE Office receives the VEC and assigns a file number

DATECOMPL -> The date the VE Office releases the completed VEC to the Area Office

ACTSVG -> The actual total savings of the VEC

CONTRNO -> The contract number affected by the VEC

MODNO -> The modification number of the contract

VEDAYS -> The amount of days it took to process the VEC at the Omaha District Office (DATECOMPL - DATEASSD)

FILENO	SUBJECT	PROJTITLE	ACTN	DATESSD	DATECOMPL	ACTSVG	CONTRNO	MODNO	VBAYS
92-01	REUSE EXIST CABLES & SYSM	REPL CEN & SYSM	1	10/29/91	12/09/91	20411	910028	002	41
92-02	ELIMINATE SAFETY OFFICER	UPGRADE LATRINE	1	11/01/91	11/05/91	4468	910149	004	4
92-03	DELETE PBX SYSTEM	ARRTC-PHASE 1	2	11/18/91	11/22/91	0	900026		4
92-04	REMOVE ADD LANDFILL MAT'L	LIVE FIRE TRAIN	1	11/19/91	12/31/91	211529	910117	001	42
92-05	UTILIZE EXISTING MANHOLES	AVUM HANGAR	1	12/03/91	12/03/91	3680	91L165	003	0
92-06	ELIM-NEED TEMP TEL. LINE	AVUM HANGAR	1	12/03/91	12/03/91	2265	91L165	003	0
92-07	TRENCH DRAINS	AVUM HANGAR	1	12/03/91	12/04/91	1715	91L165	005	1
92-08	AIR COMPRESSOR	AVUM HANGAR	3	12/03/91	12/05/91	1715	91L165	005	2
92-09	TURBINE GAS METER	AVUM HANGAR	1	12/04/91	12/10/91	1715	91L165	005	6
92-10	SOLAR HEATING	AVUM HANGAR	2	12/31/91	02/14/92	0	91L165		43
92-11	HW & GAS METER SYSTEM	ADAL PHYSIC PIT	3	01/03/92	01/15/92	0	910156		12
92-12	DELETE SPRINKLER LNS	ALTER PITNS CTR	1	01/17/92	02/21/92	7479	910152	009	35
92-13	SOLAR PANELS IMPROV HEAT	AVUM HANGAR	1	01/23/92	02/27/92	28982	91L165	010	35
92-14	NEW ROOF JOISTS	PHYSICAL PIT CT	1	01/28/92	02/07/92	3423	910151	015	10
92-15	DELETE SON PERSON	CONTROL TOWER	1	02/03/92	02/07/92	17055	91L128	005	4
92-16	PLAYGROUND SAND	CHILD DEV CNTR	1	02/05/92	02/18/92	11453	920007	003	13
92-17	STANDING SEAM ROOF	GYMNASIUM COMPLEX	2	02/20/92	02/27/92	0	910163		7
92-18	SCRS CUTTER	GYMNASIUM	2	03/04/92	03/17/92	0	910163		13
92-19	PRESSURE SAND FILTER SY	GYMNASIUM	2	03/04/92	03/17/92	0	910163		13
92-20	ELIMINATE POOL LIGHTS	GYMNASIUM	2	03/04/92	03/17/92	0	910163		13
92-21	PRIME COAT	GYMNASIUM COMPLEX	2	03/09/92	03/20/92	0	910163		11
92-22	PRIMECOAT	CONTROL TOWER	2	03/09/92	03/17/92	0	91L128		8
92-23	GLAZED BLOCK	GYMNASIUM COMPLEX	1	03/16/92	03/23/92	8046	910163	013	7
92-24	SUBDRAIN MANHOLES	AVUM HANGAR	1	03/24/92	04/09/92	556	91L165	019	16
92-25	RIDED BASE COURSE	ADAL HYD PUEL	1	04/02/92	04/16/92	14359	910052	012	14
92-26	PIPING RNC, WOOD FLOORING	CONTROL TOWER	1	04/13/92	04/24/92	2499	910174	009	11
92-27	RFC PAC ASPHALT TRAIL D18	PAPIO CRK & TRB	2	04/13/92	04/23/92	0	920038		10
92-28	RFC PAC CULVERT PIPES D18	PAPIO CRK & TRB	2	04/13/92	04/23/92	0	920038		10
92-29	D1 DRAIN	124 MAINT SHOP	1	04/23/92	05/01/92	710	92L017	011	8
92-30	CAP EXIST CONCRETE PAD	REPLACE BOILER	1	05/07/92	05/12/92	2121	910140	007	5
92-31	POOL HEATING	GYM COMPLEX	2	05/13/92	05/15/92	0	910163		2
92-32	FILL MATERIAL	MULTI TRAIN RNC	1	05/18/92	05/26/92	4810	920039	001	8
92-33	TRENCH DRAIN	ADAL MIS MAINT	1	05/26/92	06/03/92	11995	920036	010	8
92-34	REV AGRICATE CONCRETE PAV	AVUM HANGAR	1	06/05/92	06/05/92	63820	91L165	026	0
92-35	CONSERVAL QUIETTAIRE	124 VEHIC MAINT	4	06/15/92	06/30/92	0	92L017		15
92-36	RADIANT TUBE SYSTEM	124 VEHIC MAINT	4	06/15/92	06/30/92	0	92L017		15
92-37	SACATEC BIPOST	124 VEHIC MAINT	4	06/15/92	06/30/92	0	92L017		15
92-38	DELETE MORTAR BED	RANGE 109	2	06/17/92	07/15/92	0	920018		28
92-39	ELIM CONTROL DAMPER	GYMNAS COMPLEX	2	06/19/92	07/15/92	0	910163		26
92-40	FIRE PROTECTION	AVUM HANGAR	1	06/24/92	07/07/92	151	91L165	027	13
92-41	MASONRY INSPECTION	MILSTAR AT PAYB	5	06/25/92	07/15/92	0	92L055	0	20
92-42	CONCRETE MASONRY SUBSTITU	124TH VEH MAINT	2	07/07/92	07/13/92	0	92L017		6
92-43	ENDWALLS	MULTI PUR TNG RC	2	07/07/92	07/20/92	0	920039		13
92-44	GIRDER CRANE	124 VEHCL MAINT	1	07/22/92	08/20/92	8200	92L017	027	29
92-45	FIELD TEST FOR GENERATOR	MILSTAR AT PAYB	1	08/10/92	08/25/92	17888	92L055	011	15
92-46	GENERATOR CONTROLS	MILSTAR AT PAYB	1	08/10/92	08/13/92	14513	92L055	009	3
92-47	GENERATOR BATTERIES	MILSTAR AT PAYB	1	08/11/92	08/26/92	1692	92L055	012	15
92-48	RELOCATE SAND INTERCEPTOR	124 VEH MAIN SB	1	08/19/92	09/01/92	2654	92L017	029	13
92-49	PLY ASH SUB CONCRETE PYMT	124 VEH MAIN SB	3	08/19/92	09/02/92	6037	92L017	028	14
92-50	WATER DIST PIPING	ADMIN/COVD STOR	1	08/25/92	08/27/92	39945	920072	004	2
92-51	ELECTRICAL CABLE	CIS PAC	2	09/04/92	09/17/92	0	92L075		13
92-52	DEL 6MIL POLY MEMBRANE	CIS PAC	2	09/14/92	09/27/92	0	92L075		13
92-53	DEL THERITE CNTRL TRTHNT	CIS PAC	1	09/14/92	09/25/92	17913	92L075	007	11
92-54	SUBST RAD HEAT HIGH BAY	124TH VEH MNT S	2	09/22/92	10/06/92	0	92L017		14
92-55	DELETE 1 LANE CONC SLAB	ADAL HYD PUEL S	1	09/25/92	09/29/92	119942	91C052	022	4
92-56	DEL WINDOW CLEAN ANCHORS	ADMIN/STOR PAC	1	09/25/92	10/26/92	6053	92C072	006	31

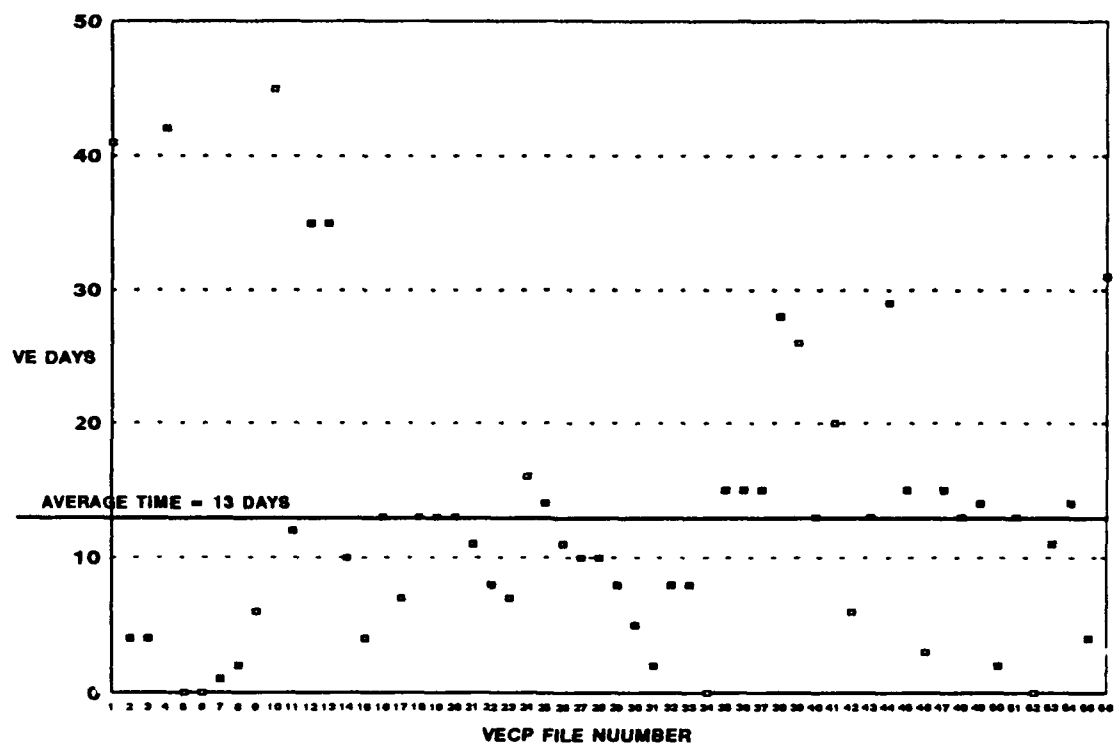
Appendix BGraphical Representations of the
VECP Processing Times

Figure B-1. FY 1992 VECPS, Omaha District

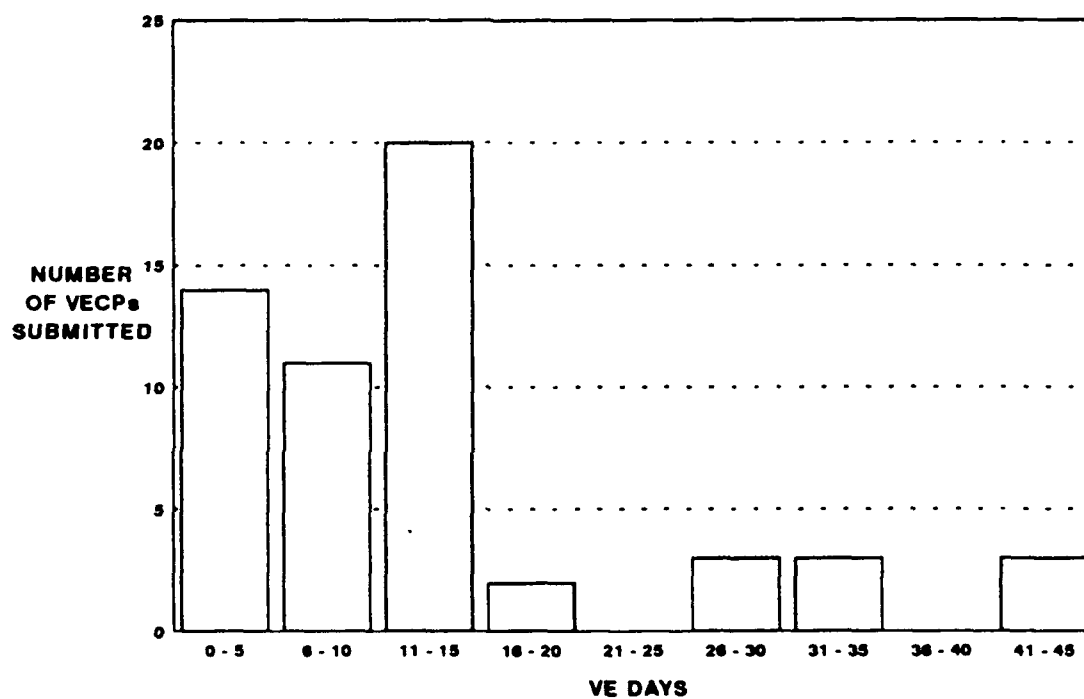


Figure B-2. Distribution of Processing Times of VECs Submitted

Appendix C

A Generic Partnering Workshop Recommended By the Associated General Contractors of America (AGC)

Agenda

9:00 - 9:15 AM	Opening Remarks of Senior Executives - Why we are here.
9:15 - 9:30 AM	Introductions
9:30 - 10:30 AM	Partnering Overview
10:30 - 10:45 AM	Exercise #1 Barriers, Problems, Opportunities

Barriers, Problems and Opportunities

- What actions does the other group engage in that create problems for us?

- What actions do we engage in that we think may create problems for them?

- What recommendations would we make to improve the situation?

(The parties will break into two groups [Owner and Contractor]. These questions are answered and then reported back to the entire group. Discussion facilitates understanding.)

11:15 - 11:45 AM	Report and Discussion in Entire Group
11:45 - 12:00 PM	Develop Mission Statement
12:00 - 1:00 PM	Lunch
1:00 - 1:15 PM	Develop Mission Statement
1:15 - 1:45 PM	Exercise #2 Interest, Goals, Objectives

Interest/Goals/Objectives

- What direct and indirect interest do we have in the outcome of this project?
- Given our interest, what are reasonable, achievable goals to which we can strive?
- What specific, measurable objectives can we identify that move us toward our goals?

(Again, the parties separate into Owner and Contractor groups. When results are reported back to the entire group, common objectives emerge. From these, a specific list of charter objectives are developed along with the mission statement.)

1:45 - 2:15 PM

Report, Discussion, Identification of Common Goals and Objectives

2:15 - 2:30 PM

Break

2:30 - 3:15 PM

Exercise #3 Issue Resolution and Team Evaluation

Issue Resolution/Team Evaluation

- What should our issue resolution policy require?
- How should the issue resolution process work?
- What are the roles and responsibilities for all levels of the partnership in issue resolution?
- How can we evaluate the progress of the partnership in achieving our goals and objectives?
- Who initiates the evaluation, who has input to the evaluation and who sees the evaluation?
- What actions should the evaluation trigger?
- Should the evaluation process include follow-up workshop(s)? If so, when and who is responsible? Who should attend?

3:15 - 4:00 PM

Report Discussion, Agree on Process and Format

4:00 PM

Sign Charter

Appendix D

The Corps of Engineers' Policy
Memorandum on Partnering



DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CEMP-2A

18 February 1992

COMMANDER'S POLICY MEMORANDUM # 16

SUBJECT: Partnering

1. The U.S. Army Corps of Engineers has traditionally sought to accomplish its missions in the most effective and efficient manner possible, and to explore better ways to do our business. In Our Vision, we pledged to forge improved relationships across a broad spectrum. One innovation that has proven successful in improving our performance during the past few years is "partnering" with construction contractors. While our past efforts have been primarily directed toward improving relationships with construction contractors, the principles of partnering can and must be applied to every internal and external customer, cost sharing partner, and contractor or issue we deal with. Relationships between project management and functional elements within a district, between districts and customers and between contracting officers and architect engineers are typical of those interactions in which we will work to minimize time consuming and costly disputes and facilitate communication for the benefit of all. The essence of partnering is promoting a cooperative attitude and the active pursuit of common goals by the parties involved.

2. Because partnering develops positive and mutually beneficial relationships, it creates a climate characterized by trust and cooperation. It creates a relationship between two or more parties and promotes teamwork. Partnering seeks to eliminate the "us" versus "them" mentality, and to form a "we" approach for the mutual benefit of the project user, the taxpayers, and the contractor. THEREFORE, IT IS THE CLEAR POLICY OF THE CORPS OF ENGINEERS TO DEVELOP, PROMOTE AND PRACTICE PARTNERING ON ALL CONSTRUCTION CONTRACTS, AND TO UNIVERSALLY APPLY THE CONCEPT TO ALL OTHER RELATIONSHIPS.

3. During the next few months, our headquarters will publish guidance and lessons learned to further our understanding and promote the implementation of partnering. All members of our team should apply the principles of partnering at every appropriate opportunity and across every facet and activity of our organization, both internally and externally.

H. J. Fitch
Lieutenant General, USA
Commanding

Appendix EA Generic Value Engineering Mini-Study Agenda

DAY 1:

0800 - 0900	Introductions and Establishing Team Objectives
0900 - 1000	Developing Creativity: A Discussion on Paradigms and Their Effects
1000 - 1200	A Brief Site Visit
1200 - 1300	Lunch (Together)
1300 - 1700	The VE Job Plan (Phases 1 - 4)

DAY 2:

0800 - 1200	The VE Job Plan (Phases 1 - 4 cont'd)
1200 - 1300	Lunch
1300 - 1700	The VE Job Plan (Phases 1 - 4 cont'd)

DAY 3:

0800 - 1200	The VE Job Plan (Phases 1 - 4 cont'd)
1200 - 1300	Lunch
1300 - 1400	Wrap-up of the VE Job Plan
1400 - 1500	Preparation for Phase 5
1500 - 1630	VE Team Briefs the Area Engineer (and staff) on Its Recommendations for Final Approval

Appendix FThe Initial Contractor's Survey

For the Initial Contractor's Survey, each contractor was sent a copy of the thesis proposal, a letter from LTC James S. Weller, Deputy District Engineer for the Omaha District, a cover sheet providing instructions and the objectives of the questionnaire, and the two page questionnaire. These documents, except for the 22 page proposal, appear in this appendix. The responses from the questionnaire appear in this appendix on page 84.

The questionnaire was developed with the assistance of Dr. Hoke S. Hill, Jr. of Clemson University's Experimental Statistics Department.



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
215 NORTH 17TH STREET
OMAHA, NEBRASKA 68102-4978



Executive Office

Dear Sir:

The Omaha District is considering testing the enclosed proposal, reference the Value Engineering Change Proposal (VECP) system. The results of this program may be beneficial to you and the Corps of Engineers.

This proposal is an attempt to enhance our value engineering system and closer align it to the concepts of partnering. Captain Mahaffee, graduate student at Clemson University, has been researching partnering and value engineering within the Corps of Engineers.

Participation in the testing of this proposal is strictly voluntary and will not affect any present or future contracts you will have with the Omaha District.

Please take the time to read the enclosed proposal and complete the enclosed questionnaire. If you have any questions on the enclosed proposal, write them on the questionnaire or call Captain Mahaffee at (803) 654-0353.

Sincerely,

James S. Weller
Lieutenant Colonel, Corps of Engineers
Deputy District Engineer

CONSTRUCTION CONTRACTOR'S QUESTIONNAIRE

Please take the time to carefully read the enclosed proposal and to complete the attached questionnaire. Place the completed questionnaire in the enclosed stamped envelope and return it by March 5, 1993.

This proposal is being sent to Construction Contractors who traditionally do business with the Omaha District, U.S. Army Corps of Engineers. The objectives of this questionnaire are:

1. To solicit your opinion of the Value Engineering Change Proposal (VECP) system within the Corps of Engineers.
2. To obtain your opinion of the enclosed proposal in regards to Value Engineering.
3. To identify Construction Contractors that are willing to participate in the testing of this proposal with the Omaha District of the Corps of Engineers.

Thank you very much for your cooperation and your time.

Sincerely,

GERALD W. MAHAFFEE
Captain, U.S. Army
Graduate Student

Construction Contractor's Questionnaire

1. How would you rate the overall effectiveness of the Value Engineering Change Proposal (VECP) system within the Corps of Engineers?

Poor Fair Good Excellent

2. How would you rate the VECP system in terms of providing mutual cost savings to your company and the Corps of Engineers?

Poor Fair Good Excellent

3. On the average, how long does it take to get the results (approval/disapproval) of a VECP once you have submitted it to the Corps of Engineers?

_____ Days Not Applicable -
I have not submitted any VECPs.

4. What do you think is a *reasonable processing time* that the Corps of Engineers should take to process a VECP and get you the results?

_____ Days Not Applicable -
I have not submitted any VECPs.

5. The present VECP system is well aligned to the concepts of partnering (mutual trust, open communication, teamwork, and decisions made at the lowest level)?

Strongly Disagree Disagree Agree Strongly Agree

6. The FY 92 and other historical data presented in the enclosed proposal was a surprise to me.

Strongly Disagree Disagree Agree Strongly Agree

7. Working on a team with the user, A/E, and the Corps of Engineers to develop VE proposals would be _____ productive as compared to the present VECP system.

Much Less Less About the Same More Much More

8. The VE Job Plan is a _____ approach of identifying areas of savings while maintaining or increasing the value of the project.

Poor Fair Good Excellent

9. The enclosed proposal is _____ than the present VECP system that exists today.

Much Worse Worse About the Same Better Much Better

10. The expenses of bringing the VE Team together should be absorbed as a developmental cost as depicted in the proposal

Yes

No

11. I would like more information on how a VE Job Plan is conducted in the Corps of Engineers.

Yes

No

12. My company currently has a project with the Omaha District which is in the early stages of construction that would benefit from a VE mini-study.

Yes

No

13. My company would be very interested in conducting a VE mini-study on future projects with the user, A/E, and the Corps of Engineers.

Yes

No

PLEASE PLACE ANY ADDITIONAL COMMENTS ON THE ENCLOSED PROPOSAL IN THE AREA BELOW:

OPTIONAL. Please provide the following information (or attach a business card):

NAME _____ JOBTITLE _____

COMPANY _____

ADDRESS _____

DAYTIME TELEPHONE _____

Responses from the Initial Contractor's Questionnaire

Question 1:

How would you rate the overall effectiveness of the Value Engineering Change Proposal (VECP) system within the Corps of Engineers?

Responses:

<u>Poor</u>	<u>Fair</u>	<u>Good</u>	<u>Excellent</u>	<u>Write-Ins</u>
2	7	4.5	0.5	1 - Don't Know

Comments Provided:

"Effectiveness could be improved with increased interest during evaluation/approval cycle instead of just another business function. When handled at the project level, interest is good and results are effective. When handled at the district/higher level, interest is less evident and results are more difficult to come by."

Question 2:

How would you rate the VECP system in terms of providing mutual cost savings to your company and the Corps of Engineers?

Responses:

<u>Poor</u>	<u>Fair</u>	<u>Good</u>	<u>Excellent</u>	<u>Write-Ins</u>
1	3	8	2	1 - Unknown

Comments Provided:

None.

Question 3:

On the average, how long does it take to get the results (approval/disapproval) of a VECP once you have submitted it to the Corps of Engineers?

Responses:

12 Days	14 Days	21-30 Days	30 Days (or less)
15-30 Days for disapprovals and 30-45 for a modification (approvals)			
30 Days	30 Days	30 Days	30 Days (or more)
10-60 Days	30-45 Days	60 Days	90 Days

* 2 responded with Not Applicable.

Response Average: 34.92 Days

Comments Provided:

None.

Question 4:

What do you think is a reasonable processing time that the Corps of Engineers should take to process a VECP and get you the results?

Responses:

5 Days	7 Days	10 Days	10 Days
15 Days	15 Days	15 Days	15 Days
14-21 Days*	20 Days	15-45 Days*	30 Days
30 Days	30 Days*	Not Applicable	

* Depending on the complexity of the VECP submitted.

Response Average: 17.82 Days

Comments Provided:

None.

Question 5:

The present VECP system is well aligned to the concepts of partnering (mutual trust, open communication, teamwork, and decisions made at the lowest level)?

Responses:

<u>Strongly Disagree</u>	<u>Disagree</u>	<u>Agree</u>	<u>Strongly Agree</u>	<u>Write-Ins</u>
0	8.5	5.5	0	1 - Not Sure

Comments Provided:

"Agree at project level, disagree at succeeding higher levels which become involved based on the value of the VECP."

Question 6:

The FY 92 and other historical data presented in the enclosed proposal was a surprise to me.

Responses:

<u>Strongly Disagree</u>	<u>Disagree</u>	<u>Agree</u>	<u>Strongly Agree</u>	<u>Write-ins</u>
0	6	8	0	1 - No Answer

Comments Provided:

"The VE savings should be related to contract value to determine a relative percentage of savings in addition to the total VE savings."

Question 7:

Working on a team with the user, A/E, and the Corps of Engineers to develop VE proposals would be _____ productive as compared to the present VECP system.

Responses:

<u>Much Less</u>	<u>Less</u>	<u>About the Same</u>	<u>More</u>	<u>Much More</u>	<u>Write-Ins</u>
1	1	3	7	3	0

Comments Provided:

Two contractors that responded with "More" added the following comments:

"Depending on the size and complexity of the project."

"However, guidelines for savings, product liability (A/E), and pride of authorship must be firmly established yet flexible to yield to differing conditions. Since brainstorming is the basic principle, all parties must agree to leave any idea generated in the VECP system."

Question 8:

The VE Job Plan is a _____ approach of identifying areas of savings while maintaining or increasing the value of the project.

Responses:

<u>Poor</u>	<u>Fair</u>	<u>Good</u>	<u>Excellent</u>	<u>Write-Ins</u>
1	2	7.5	3.5	0

Comments Provided:

The contractor who answered with "Good to Excellent" conditioned his response with:

"Depending on the size and complexity of the project."

"Must make allowances for time constraints. Due to engineering time and material procurement, will be most effective at job start, not later on."

Question 9:

The enclosed proposal is _____ than the present VECF system that exists today.

Responses:

<u>Much Worse</u>	<u>Worse</u>	<u>About the Same</u>	<u>Better</u>	<u>Much Better</u>	<u>Write-Ins</u>
0	1	4	7	2	1 - No Answer

Comments Provided:

"How can we know for sure in advance?"

"The handling of costs is confusing and the A/E has no real benefit to gain. The proposal is similar to current processes and other than the mini-study, has no new content. The more difficult aspect of the VE process is not the generation of ideas, but consideration and implementation of the process once an idea is generated."

Question 10:

The expenses of bringing the VE Team together should be absorbed as a developmental cost as depicted in the proposal.

Responses:

<u>Yes</u>	<u>No</u>	<u>Write-Ins</u>
7	7	1 - No Answer

Comments Provided:

"... I don't think you will get hardly any contractors to pay for the A/E (would rather do without the A/E and/or VE Plan)"

"A/E Fee on breakeven or less must be paid by the Corps or Owner."

"The expenses for the VE Team are unreasonable. The Government has already paid a Designer/Architect to design a functional facility at the least expensive impact. ...The design team should include expenses in their proposal for VE since they are also benefiting from the contractors experience for future projects."

Question 11:

I would like more information on how a VE Job Plan is conducted in the Corps of Engineers.

Responses:

<u>Yes</u>	<u>No</u>	<u>Write-Ins</u>
6	8	1 - No Answer

Special Note:

All contractors responding with a "Yes" were sent a copy of the 30 page document Value Engineering in the COE (published by the U.S. Army Corps of Engineers).

Question 12:

My company currently has a project with the Omaha District which is in the early stages of construction that would benefit from a VE Mini-Study.

Responses:

<u>Yes</u>	<u>No</u>	<u>Write-Ins</u>
1	12	1 - No Answer
		1 - Unknown (PM from a very large company)

Special Note:

The name of the one contractor that responded "Yes" was given to the VE office at the Omaha District. Steve Moore, VE Officer, contacted the contractor and reported that it did not appear to be a good candidate for a VE Mini-Study.

Question 13:

My company would be very interested in conducting a VE Mini-Study on future Projects with the user, A/E, and the Corps of Engineers.

Responses:

<u>Yes</u>	<u>No</u>	<u>Write-Ins</u>
12	2	1 - Maybe

Comments Provided:

"Depending on the type of project."

Additional Comments About the Questionnaire and Proposal:

"Not enough VECs are, or have been, identified on previous projects (last 15 years for us) to make it worth the cost (risk) to spend 3 days plus pay for the Travel and A/E costs just to see if we can I.D. possible savings."

"It would seem that there may be more benefit to be gained by a mini-study of the VE issue in lieu of a questionnaire, panel discussion, brainstorm, etc."

"With the schedules that are now bid on projects and the LDs (liquidated damages) applied, we don't really have a lot of time to study any VE proposal very long."

"1. An informal meeting (i.e. - a conference call) should be conducted before VE Team or Mini-Study is brought together to:

- A) get on an agenda
- B) get preliminary feeling on changes or improvements
- C) Save costs if a VE Team would not be beneficial

2. A 3 day meeting and a 2 day partnering meeting are too long."

"This is a new approach and is worth a try. I would guess however that it won't produce a big increase in accepted VE proposals..."

"We strongly urge the partnering approach. ...It presents an opportunity for the contractor to suggest savings and even a more superior product. However trust and participation by all is necessary. When these ingredients are present, a successful Value Engineer process can take place..."

Appendix GThe Second Contractor's Survey

The Second Contractor's Survey consisted of a questionnaire to the contractors who responded to the Initial Contractor's Survey. Since two contractors responding to the first survey did not provide any names or return addresses, only 13 questionnaires were sent out in the Second Contractor's Survey. All 13 contractors responded to this survey.

CPT Gerald W. Mahaffee
200 Wren Street
Clemson, SC 29631
Phone- (803) 654-0353

9 April 1993

Name of Contractor
Address

Dear Sir,

Thank you for responding to the my thesis proposal on "Enhancing Value Engineering in the U.S. Army Corps of Engineers." Your input proved to be very valuable in my research.

Because you responded, I would like to provide you with a little feedback from the survey of general contractors (with 13 general contractors responding). In general, most of the contractors were favorable to the idea of conducting a VE Mini-Study with the Corps of Engineers (only two contractors were not interested in conducting a VE Mini-Study with the Corps). Two areas in particular received mixed reviews: the duration of the VE Mini-Study (recommended 3 days) and the risk assumption of the developmental costs (with the contractor assuming the risk of bringing the VE Team together).

I have learned in the responses that the VE Mini-Study proposed is not applicable to all general contractors. Your individual experience with the Corps of Engineers, your partnering experience with the Corps, and the type/size of projects that you normally perform for the Corps of Engineers played an important role in your responses (whether positive or negative).

Enclosed is a brief questionnaire which inquires about your company. The purpose of this questionnaire is to establish any trends why certain general contractors are extremely favorable with the proposal while others are not interested in it. If you would like, I will keep all information provided confidential.

Please take a couple of minutes and fill out the enclosed questionnaire. If you have any questions, please fill free to call me. Once again, your valuable time is very appreciated.

Sincerely,

Gerald W. Mahaffee
Captain, U.S. Army

1 encl.

SECOND CONSTRUCTION CONTRACTOR'S QUESTIONNAIRE

Response from: Contractor's Name
Company Name

1. My company has had, or currently has, a partnering relationship with the Corps of Engineers.

YES

NO

2. In general, I would rate our partnering with the Corps of Engineers as _____.

Poor

Fair

Good

Excellent

Does not apply

3. My company generally does the following types of projects for the Corps of Engineers: (you may check more than one)

- _____ Small misc. construction projects (usually under \$1 million)
- _____ General purpose buildings (offices, barracks,...)
- _____ Special purpose buildings (hospitals, training facilities,...)
- _____ Water (civil works) structures (Locks, dams,...)
- _____ Paving operations (airfields, roads,...)
- _____ Special purpose structures (hangars, parking garages,...)
- _____ Large earth moving operations
- _____ Environmental clean-up projects
- _____ Other - Please list:

4. My company will normally bid on projects of this size: (you may check more than one)

- _____ \$500,000 or less
- _____ \$500,000 to \$2 million
- _____ \$2 million to \$5 million
- _____ \$5 million to \$10 million
- _____ \$10 million to \$50 million
- _____ \$50 million to \$100 million
- _____ \$100 million to \$200 million
- _____ \$200 million or greater

5. The annual volume of work my company performs is \$_____ million in construction.

6. I would like the information above to be kept confidential.

YES

NO - It doesn't matter

Responses from the Second Contractor's Questionnaire

Question 1:

My company has had, or currently has, a partnering relationship with the Corps of Engineers.

Responses:

<u>YES</u>	<u>NO</u>	<u>Write-Ins</u>
8	4	1 - Not Formally

Question 2:

In general, I would rate our partnering with the Corps of Engineers as _____.

<u>Poor</u>	<u>Fair</u>	<u>Good</u>	<u>Excellent</u>	<u>Does Not Apply</u>
0	1	4	4	4

Question 3:

My company generally does the following types of projects for the Corps of Engineers: (you may check more than one)

- 3 Small misc. construction projects (usually under \$1 million)
- 9 General purpose buildings (offices, barracks,...)
- 10 Special purpose buildings (hospitals, training facilities,...)
- 4 Water (civil works) structures (Locks, dams,...)
- 2 Paving operations (Airfields, roads,...)
- 6 Special Purpose Structures (hangars, parking garages,...)
- 1 Large earth moving operations
- 6 Environmental clean-up projects
- 0 Other:

Question 4:

My company will normally bid on projects of this size: (you may check more than one)

- 6 \$500,000 or less
8 \$500,000 to \$2 million
9 \$2 million to \$5 million
11 \$5 million to \$10 million
8 \$10 million to \$50 million
4 \$50 million to \$100 million
4 \$100 million to \$200 million
3 \$200 million or greater

Question 5:

The annual volume of work my company performs is \$_____ million in construction.

Responses:

\$5 million	\$5 - 7 million	\$7 million	\$8 million
\$10 million	\$10 - 20 million	\$35 million	\$45 million
120 million	\$500 million - \$1 billion		\$685 million
\$700 million	\$2 - 3 billion		

Question 6:

I would like the information above to be kept confidential.

YES NO - It doesn't matter

Write-Ins

3

9

1 - No Response

Appendix H

The Corps of Engineers' Survey

The Corps of Engineers' Survey consisted of sending a questionnaire to seven experts within the Corps of Engineers. The experts consisted of five Value Engineering Officers and two Deputy District Engineers. Six of the Seven experts were familiar with the thesis proposal and had input into its development. The one expert not familiar with the proposal was sent a copy of the proposal along with the questionnaire.

CORPS OF ENGINEERS QUESTIONNAIRE

The responses from the general contractors on the proposal varied greatly from full acceptance to not at all interested. Initial conclusions are that the proposed VE Mini-Study will not work on all projects and with all contractors.

1. Success of a VE Mini-Study will depend on several criteria. In your opinion, which of the criteria that will effect the success of a VE Mini-Study?

Please place a number by each item where:

1 - Very Important 2 - Somewhat Important 3 - Not Very Important

- _____ Project Size in Terms of Dollars (What dollar amount would you use as a good cut-off value? _____)
- _____ Project Size in Terms of Duration (How long should the project last to make it a good VE Mini-Study candidate? _____)
- _____ Unique/Specialized Projects (What are some examples of unique projects you would look for? _____)
- _____ Whether or Not the Project is Partnered
- _____ The Personalities of the General Contractor/Corps of Engineers
- _____ Project Location
- _____ The Materials/Equipment specified for the Project
- _____ The A/E of the Project
- _____ The Customer/End User of the Project
- _____ Other:

2. Several of the contractors did not like idea of the A/E being present at the VE Mini-Study. Do you think the presence of the A/E is necessary for a successful VE Mini-Study?

YES

NO

Optional Comments:

3. Some contractors felt that the recommended duration of three days was too long. For these contractors, would you be in favor of conducting a VECP review meeting lasting no longer than one day which would review all of his ideas before he submits his formal VECP to the Corps of Engineers? (The purpose of this review meeting would be to give immediate preliminary feedback to his ideas before he invests the time/money into a formal VECP.)

YES

NO

Optional Comments:

4. Would you be in favor of the development of a VECP "Short Form" that could be applied to minor, non-structural items? (An example of this would be the recommendation to change wall vent covers from metal to plastic.)

YES

NO

Optional Comments:

5. Do you think the District Value Engineering Officer should be represented at all formal partnering sessions?

YES

NO

Optional Comments:

6. Is there any way the Corps of Engineers could assume more of the risk involved with bringing the VE Mini-Study together? (For example, pay for the travel/per diem of the Corps personnel and claim these expenses as VE developmental costs)

YES

NO

Optional Comments:

7. What other ideas do you have to increase the participation of the contractor in the Corps of Engineers Value Engineering Program?

Responses From the Corps of Engineers QuestionnaireQuestion 1:

Success of a VE Mini-Study will depend on several criteria.
In your opinion, which of the criteria that will effect the
success of a VE Mini-Study?

Please place a number where:

1 - Very Important 2 - Somewhat Important 3 - Not Very Important

Responses:

____ Project Size in Terms of Dollars

<u>1 - Very Important</u>	<u>2 - Somewhat Important</u>	<u>3 - Not Very Important</u>
3	4	0

Average - 1.57

What dollar amount would you use as a good cut-off value?

<u>\$2 Million</u>	<u>\$5 Million</u>	<u>\$8 - 10 Million</u>
3	3	1

Average - \$4.29 Million

____ Project Size in Terms of Duration

<u>1 - Very Important</u>	<u>2 - Somewhat Important</u>	<u>3 - Not Very Important</u>
1	2	3

Average - 2.33 (one no response)

How long should the project last to make it a good VE Mini-Study
candidate?

<u>12 months</u>	<u>18 months</u>	<u>Other</u>
3	1	One N/A
		Two no responses

Average - 13.5 months

Question 1 Responses (cont'd)Unique/Specialized Projects

<u>1 - Very Important</u>	<u>2 - Somewhat Important</u>	<u>3 - Not Very Important</u>
2	4	1

Average = 1.86

What are some examples of unique projects you would look for?

- State of the art and new standard designs.
- Mechanical, large hangar doors, specialty items.
- New technologies.
- RF shielding, Treatment HTRW.

Three No Responses

Whether or Not the Project is Partnered

<u>1 - Very Important</u>	<u>2 - Somewhat Important</u>	<u>3 - Not Very Important</u>
3	2	2

Average = 1.86

The Personalities of the General Contractor/Corps of Engineers

<u>1 - Very Important</u>	<u>2 - Somewhat Important</u>	<u>3 - Not Very Important</u>
2	5	0

Average = 1.71

Project Location

<u>1 - Very Important</u>	<u>2 - Somewhat Important</u>	<u>3 - Not Very Important</u>
0	1	5

Average = 2.83

(one no response)

Question 1 Responses (cont'd)

___ The Materials/Equipment specified for the Project

<u>1 - Very Important</u>	<u>2 - Somewhat Important</u>	<u>3 - Not Very Important</u>
2	3	2

Average = 2.00

___ The A/E of the Project

<u>1 - Very Important</u>	<u>2 - Somewhat Important</u>	<u>3 - Not Very Important</u>
0	5	2

Average = 2.29

___ The customer/End User of the Project

<u>1 - Very Important</u>	<u>2 - Somewhat Important</u>	<u>3 - Not Very Important</u>
4	2	1

Average = 1.57

Other Responses Provided:

___ Other:

1 How critical is need date of facility versus contract completion date.

1 Management commitment. Both Corps and customer.

Question 2:

Several of the contractors did not like the idea of the A/E being present at the VE Mini-Study. Do you think the presence of the A/E is necessary for a successful VE Mini-Study?

Responses:

<u>YES</u>	<u>NO</u>	<u>Write-Ins</u>
4	3	0

Optional Comments:

"The contractor is the key player. He will be the one to determine what the reduction in cost of performance is for the contract. Everyone else can only throw out ideas."

"But it would be helpful in order to understand design intent."

"No, not critical but beneficial. While the A/E may be somewhat defensive about his design, he can provide valuable information on how/why it was designed the way it was. Some of this could be answered by the Corps TM or designers, but an A/E representative would be best."

"Not necessarily for all the study but at start and for his comments at completion."

"The A/E has the most knowledge of the technical design and user's needs."

"They may have already considered some issues and will be able to provide info as to why something should or should not be considered."

"The A/E needs to be present for institutional knowledge. This is very beneficial. Some pride of authorship will be displayed, but a good facilitation and human relations will work through it."

Question 3:

Some contractors felt that the recommended duration of three days was too long. For these contractors, would you be in favor of conducting a VECP review meeting lasting no longer than one day which would review all of his ideas before he submits his formal VECP to the Corps of Engineers? (The purpose of this review meeting would be to give immediate preliminary feedback to his ideas before he invests the time/money into a formal VECP.)

Responses:

<u>YES</u>	<u>NO</u>	<u>Write-Ins</u>
7	0	0

Optional Comments:

"Most of the VE offices attempt to assist the contractor informally to ensure that he is not working on a negative proposal."

"One day is enough. 1) Review his ideas and 2) Propose other ideas."

"3 days appears to be too long. Costs versus benefits may argue for 1 or 2 days."

"It would depend how much detail contractors ideas have."

"Yes but, the contractor will need to need to have had time (along with all subs) to perform a detailed review and develop VECPs. Also a quick summary of a VECP should be submitted to the COE and to the A/E before the meeting to speed the review process."

"A lot can be accomplished in a short amount of time if the participants are focused and well facilitated. One day will be ample in many cases."

"After further investigation and reflection, it would probably be better to limit the VE Mini-Study to 1 to 1½ days. Length of study should correlate to size and complexity of project. Only very tentative approval could be given with so little time for review."

Question 4:

Would you be in favor of the development of a "VECP Short Form" that could be applied to minor, non-structural items? (an example of this would be the recommendation to change wall vent covers from metal to plastic.)

Responses:

<u>YES</u>	<u>NO</u>	<u>Write-Ins</u>
6	1	0

Optional Comments:

"The Resident Engineer should have this authority on non-critical proposals."

"No. FAR 52.248-3 is explicit in submittal requirements. This is not an option."

"Whatever can be done to eliminate paper and speed the process."

"The simpler, quicker, the better."

"Usually my VECPs are submitted in "letter form" and need only to address the items to be changed. Schedule impact, cost, and the technical change are all that needs to be addressed."

Question 5:

Do you think the District Value Engineering Officer should be represented at all formal partnering sessions?

Responses:

<u>YES</u>	<u>NO</u>	<u>Write-Ins</u>
3	4	0

Optional Comments:

"Never say ALL - Everyone should be considering VE's all the time."

"A select few to understand field problems. He should be present at good candidate projects."

Question 5 (cont'd)

"Yes, should provide orientation/instruction."

"Yes, (but) workload may not allow this."

"Some , but not all. Some exposure is good for the VEO. Case by case should be examined. Some VE items may fall out of the partnering sessions."

"Other Corps representatives already present are familiar with VECP submittal procedures. The VEO will attend some of the larger projects and others upon request."

Question 6:

Is there any way the Corps of Engineers could assume more of the risk involved with bringing the VE Mini-Study together? (For example, pay for the travel/per diem of the Corps personnel and claim these expenses as VE developmental costs.)

Responses:

<u>YES</u>	<u>NO</u>	<u>Write-Ins</u>
5	1	1 - Not Sure

Optional Comments:

"Not sure. Everything we do is charged to the project and everyone says we cost too much."

"The Corps already receives $\frac{1}{2}$ for Engineering During Construction (EDC) so this should not be a problem."

"FAR 52.248-3 does not provide for such costs. Would reduce contractor share of savings. See definition of 'Government Costs' in the Incentive Clause. The Government would have to absorb costs in S&A or in overall VE Program cost if approved by the appropriate authority."

"Be careful here. This can bite you. Contractor must concur up front. Put in writing. All parties agree. Good communications is a must."

"It may be possible to charge Corps personnel to developmental costs."

Question 7:

What other ideas do you have to increase the participation of the contractor in the Corps of Engineers Value Engineering Program?

Comments:

"Personal contact... telephone by the VEO is good! Take care of the customer. Good rapport and communications help. Contact should be made right after contract award."

"1) Educate - improve the quality of proposals. 2) Promotion - Pre-work conferences, etc. 3) Work to improve the approval rate."

"We need to publicize the 60 - 70% acceptance rate and that we have approved a number of VECs for more than \$1 million."

"Make it simpler (easier), quicker."

"Provide good examples of success stories."

"Get him/her quick answers - even if the answer is NO. Need an answer so the contractor can get things ordered."

Appendix IRespondents of the Surveys Conducted**Contractors**

Mr. Leonard Blinderman, CEO, Blinderman Construction Company
Mr. William D. Borum, Vice President, ICF Kaiser Engineers
Mr. John C. Flor, Owner/Corporate Vice President, F & B Constructors, Inc.
Mr. James Fowler, President, Fowler and Hammer, Inc.
Mr. L.F. (Frank) Jones, Jr., Project Manager, EBASCO/NEWBERG
Mr. Ron LaCount, President, ROLAC Contracting, Inc.
Mr. Glenn Moen, Project Manager, Baukol Builders
Mr. Mark Peterson, Project Manager, Peterson Construction Company
Mr. Bob Phillips, Project Manager, Hensel Phelps Construction Company
Mr. Jim Rice, Project Manager, Lillard and Clark Construction Company
Mr. James E. Schmitt, President, C. Iber and Sons, Inc.
Mr. F. Lee Smith, Manager of Federal Environmental Programs, Bechtel, Inc.
Mr. Rick Squires, Project Manager, GE Johnson Construction Company

Corps of Engineers

Mr. Merle Braden, VE Officer of the Kansas City District
Mr. Ted A. Dahlberg, Chief of Value Engineering, Corps of Engineers
Mr. Steve Moore, VE Officer of the Omaha District
LTC Paul Rojko, Deputy District Engineer of the Omaha District
Mr. Ken True, VE Officer of the Missouri River Division
Mr. Joseph Waits, VE Officer of the Mobile District
LTC James S. Weller, Deputy District Engineer of the Omaha District

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